PROCEEDINGS

OF

THE CHEMICAL SOCIETY.

Vol. XXVI. Nos. 365—379.
JANUARY—DECEMBER, 1910.

LONDON:
GURNEY & JACKSON, 10, PATERNOSTER ROW.
1911.

RICHARD CLAY AND SONS, LIMITED,
BREAD STREET HILL, E.C., AND
BUNGAY SUFFOLK.

LIST OF GRANTS MADE FROM THE RESEARCH FUND DURING THE YEAR 1910.

£6 to G. H. J. Adlam: atomic weight determinations.

£5 to W. C. Ball: bismuthinitrites.

£10 to C. O. Bannister: action of various admixtures made with ore in roasting processes for galena.

£5 to N. Bland: berberinal, oxyberberine, and dihydroberberine.

£5 to O. L. Brady: composition and constitution of aconitine.

£5 to H. Browning, jun.: synthetic formation of closed chains.

£5 to H. T. Clarke: mutual influence of unsaturated atoms in open chain and cyclic organic compounds.

£10 to A. Clayton: preparation and constitution of coumarinic acids (continued).

£5 to W. W. Close: kinetics of reactions of carboxylic acids, phenols, aldehydes, and ketones.

£5 to J. B. Cohen: the space formula for quinquevalent nitrogen.

£5 to C. H. Desch: process of diffusion in solid substances (continued).

£7 to Miss M. E. Dobson: attempt to synthesise berberine (continued).

£15 to J. G. M. Dunlop: preparation of 3:3-dimethyl-1-trimethyl-enepiperidinium iodide.

£7 to F. P. Dunn: stereoisomerism of the oximes.

£5 to A. E. Dunstan: relation between viscosity and chemical constitution (continued).

£7 to A. E. Dunstan: correlation of viscosity and other physical properties.

£5 to A. J. Ewins: mutual solubility of liquids.

£6 to T. Ferns: reactions of some derivatives of sulphonic acids.

£10 5. 8. to J. A. N. Friend: corrosion of metals.

£15 to C. S. Gibson: resolution of substances containing asymmetric atoms of nitrogen, phosphorus, and other elements of the same group into their optically active components.

£5 to C. Gilling: hydroaromatic ketones (continued).

£5 to W. Godden: isocoumarin.

£5 3. to P. Haas: action of bromine on hippuric acid.

£5 to V. J. Harding: substitution of derivatives of aromatic hydroxy-compounds.

£20 to W. N. Haworth: constitution of sylvestrene. Synthesis of camphenilene, norcamphor, and fenchene.

£8 to A. Holt, jun.: atomic weight of phosphorus.

£10 to F. Holt: preparation of $\alpha\alpha'$-dibrom-β-methyladipic acid and its transformation into β-methylpyrrolidine.

£7 to E. Hope: synthesis of methylbutanetricarboxylic acids.

£15 to E. Hope: condensation of nitromeconine, nitrophthalide, and other nitro-compounds with cotarnine.

£5 to W. J. Jarrard: mellitic acid and its derivatives.

£10 to F. R. Lankshear: compounds of manganese.

£10 to A. Lapworth: attempt to synthesise compounds related to norpinic acid.

£7 to H. R. Le Sueur: preparation of secondary amines from carboxylic acids.

£7 to T. M. Lowry: dynamic isomerism (continued).

£15 5. to W. H. Mills: stereoisomeric investigation of hydrazones, phenylhydrazones, and carbazones.

£10 to J. R. Partington: state of ionisable solutes in absolute alcohol.

£5 to W. H. Patterson: nature of occluded hydrogen, etc.

£5 to S. P. U. Pickering: nature of cupri-compounds.

£10 to J. N. Pring: union of carbon and hydrogen at high temperatures.

£5 to W. M. Roberts: guaiacol and its derivatives.

£10 to R. Robinson: synthesis of hydrastine.

£10 to N. V. Sidgwick: measurement of the rate of hydration of acid anhydrides.

£10 to J. L. Simonsen: certain tetramethylbenzenes.

£10 4. 8. to S. Smiles: action of sulphuric acid on certain hydroxy-aromatic sulphoxides.

£10 to A. W. Stewart: influence of conjugation on absorption spectra.

£5 to J. J. Sudborough: influence of double bonds on the rate of chemical reactions.

£5 to F. B. Thole: relation between viscosity and chemical constitution.

£6 to Miss G. M. Walsh: condensation of 1-methyl methoxy-4-ethyl carbonate acetophenone with piperidine, and the investigation of certain organic substances which may possess some value as perfumes.

Total amount granted during 1910 = £378. 18. 4.

LIST OF FELLOWS ELECTED DURING 1910.

Name.	Proposed.	Elected.
Adams, Percival Frederick	December 16th, 1909	February 17th.
Applebey, Malcolm Percival	October 20th, 1910	December 1st.
Auchinleck, Gilbert Grahame	December 2nd, 1909	February 17th.
Banerjee, Manindranath	October 20th, 1910	December 1st.
Banister, Fred	December 2nd, 1909	February 17th.
Barwick, Fred Wilkinson	October 20th, 1910	December 1st.
Batley, Ward Allen	May 26th, 1910	June 16th.
Baume, Georges	March 3rd, 1910	May 5th.
Berens, Herbert Arthur	January 20th, 1910	February 17th.
Bethwaite, John	March 17th, 1910	May 5th.
Bhattacharya, Sarat Chandra	October 20th, 1910	December 1st.
Bosworth, Stewart McGregor	,, ,, ,,	,, ,,
Bourdillon, Robert Benedict	February 17th, 1910	May 5th.
Bracewell, Geoffrey Alfred	April 21st, 1910	June 16th.
Bracher, André	October 20th, 1910	December 1st.
Brady, Frederick Hugh Rochfort	,, ,, ,,	,, ,,
Brady, Oscar Lisle	March 3rd, 1910	May 5th.
Briggs, John C.	October 20th, 1910	December 1st.
Briscoe, Henry Vincent Aird	June 16th, 1910	,, ,,
Brown, John	October 20th, 1910	,, ,,
Buchner, Eduard	January 20th, 1910	February 17th.
Buswell, Henry Leslie Farmer	March 3rd, 1910	May 5th.
Buttle, Bertram Haward	November 3rd, 1910	December 1st.
Camp, Frank Anthony	November 3rd, 1910	December 1st.
Canton, Howard	December 2nd, 1909	February 17th.
Cardoso, Ettore	February 17th, 1910	May 5th.
Challenger, Frederick	October 20th, 1910	December 1st.
Cheetham, Thomas Patrick	March 3rd, 1910	May 5th.
Child, Arthur James	January 20th, 1910	February 17th.
Clarke, Herbert Edmund	February 3rd, 1910	May 5th.
Cocks, Reginald Henry	January 20th, 1910	February 17th.
Colgate, Reginald Thomas	October 20th, 1910	December 1st.
Collet, Ronald Leslie	May 26th, 1910	June 16th.
Cooper, Leonard Harry	January 20th, 1910	February 17th.
Coslett, Thomas Watts	October 20th, 1910	December 1st.
Coventry, Bernard Okes	January 20th, 1910	February 17th.
Cram, Marshall Perley	November 17th, 1910	December 1st.
Crawford, David Chalmers	,, 3rd, 1910	,, ,,
Crichton, Charles	,, 17th, 1910	,, ,,
Cumming, Alexander Charles	December 16th, 1909	February 17th.
Dand, Middleton Henry	May 5th, 1910	June 16th.
Das, Tarak Nas	December 16th, 1909	February 17th.
Davies, John Hughes	October 20th, 1910	December 1st.
Dickson, Thomas William	March 3rd, 1910	May 5th.

Name.	Proposed.	Elected.
Dodd, Alexander Scott	April 21st, 1910	June 16th.
Dodd, Arthur	November 3rd, 1910	December 1st.
Duncan, James Hugh	October 20th, 1910	,, ,,
Emmett, William Gidley	October 20th, 1910	December 1st.
Emslie, Benjamin Leslie	January 20th, 1910	February 17th.
Ensor, Ainslie Jackson	October 20th, 1910	December 1st.
Everest, Arthur Ernest	December 16th, 1909	February 17th.
Farrands, Harry	March 17th, 1910	May 5th.
Finlayson, John George	October 20th, 1910	December 1st.
Forster, Aquila	December 16th, 1909	February 17th.
Garland, Charles Samuel	March 17th, 1910	May 5th.
Goddon, George Alexander	October 20th, 1910	December 1st.
Goldsbrough, Harold Albert	March 3rd, 1910	May 5th.
Gramont, Count Arnaud de	November 17th, 1910	December 1st.
Grieve, James	April 21st, 1910	June 16th.
Guhlmann, Charles Frederick	May 26th, 1910	,, ,,
Hackford, John Edward	May 5th, 1910	June 16th.
Handley, John	January 20th, 1910	February 17th.
Harrison, Edwin	March 17th, 1910	May 5th.
Haycock, John	April 21st, 1910	June 16th.
Hayhurst, Walter	January 20th, 1910	February 17th.
Holt, Fred	November 3rd, 1910	December 1st.
Huck, John	April 21st, 1910	June 16th.
Hughes, Herbert Hillier	December 2nd, 1909	February 17th.
Jacobs, Lionel Leslie	May 26th, 1910	June 16th.
Jaques, Arthur	November 18th, 1909	February 17th.
Jenkins, Leslie Charles W.	January 20th, 1910	,, ,,
Jones, William Jacob	February 3rd, 1910	May 5th.
Joshi, Govind Laxman	May 5th, 1910	June 16th.
Kenner, James	March 3rd, 1910	May 5th.
Khan, Prince Mahmood Ali	November 3rd, 1910	December 1st.
Knecht, Edmund	October 20th, 1910	,, ,,
Knight, William Arthur	,, ,, ,,	,, ,,
Krall, Hans	January 20th, 1910	February 17th
Kwoh, Sea-Kwain	March 3rd, 1910	May 5th.
Lamb, Samuel	March 3rd, 1910	May 5th.
Lambert, Bertram	October 20th, 1910	December 1st.
Lavender, John Herbert	January 20th, 1910	February 17th.
Leechman, Alleyne	November 17th, 1910	December 1st.
Lewis, Frederick Charles	February 3rd, 1910	May 5th.
Lewis, Samuel Judd	November 18th, 1909	February 17th.
Long, Frank Stevenson	May 5th, 1910	June 16th.
Longman, Charles Herbert Bell	February 17th, 1910	May 5th.
Low, Kenneth Stewart	October 20th, 1910	December 1st.
Lowe, Clement Ward	,, ,, ,,	,, ,,
Lucking, Hubert Leslie	February 3rd, 1910	May 5th.
McBeath, John William	December 16th, 1909	February 17th.
MacGeorge, David Jackson	June 16th, 1910	December 1st.

Name.	Proposed.	Elected.
McNish, Malcolm	October 20th, 1910...	December 1st.
Majima, Rikō	,, ,, ,,	,, ,,
Marcan, Alexander	January 20th, 1910...	February 17th.
Martin, William Ernest	May 26th, 1910	June 16th.
Mason, Horace George	March 17th, 1910 ...	May 5th.
Masson, James Irvine Orme	October 20th, 1910...	December 1st.
Meanwell, Charles Wright	December 16th, 1909	February 17th.
Merton, Thomas R.	October 20th, 1910...	December 1st.
Mitchell, Alec Duncan	June 16th, 1910	,, ,,
Mitra, Dhirendranath	October 20th, 1910 ...	,, ,,
Moore, Harold	,, ,, ,,	,, ,,
Murch, Douglas Wilshin	December 2nd, 1909...	February 17th.
Myers, James Eckersley	November 3, 1910 ...	December 1st.
Nair, Valliyil Govindan	October 20th, 1910 ...	December 1st.
Narbeth, Benjamin Mason	May 26th, 1910	June 16th.
Neal, George Williams	January 20th, 1910...	February 17th.
Needs, Francis Edwin	March 17th, 1910	May 5th.
Newman, Sidney Herbert	November 3rd, 1910	December 1st.
Nicholson, Philip Brady	January 20th, 1910...	February 17th.
Oakley, Robert O'Field	May 26th, 1910	June 16th.
Palmer, Gilbert	January 20th, 1910...	February 17th.
Paris, Edward Talbot	April 21st, 1910	June 16th.
Paterson, John Hamilton	October 20th, 1910 ...	December 1st.
Pennington, Alfred John	,, ,, ,,	,, ,,
Posford, Benjamin Ashwell	,, ,, ,,	,, ,,
Prasad, Hari	,, ,, ,,	,, ,,
Preston, Knowles	March 3rd, 1910	May 5th.
Ramsden, Frederick Valentine	October 20th, 1910 ...	December 1st.
Ransome, Alfred Oswald	November 3rd, 1910...	,, ,,
Rattey, Clifford Clare	January 20th, 1910...	February 17th.
Rau, Malur Srinivasa	,, ,, ,,	,, ,,
Reddie, John Alexander	May 26th, 1910	June 16th.
Reed, Walter William	May 5th, 1910..... ...	,, ,,
Rees, John James Beaumont	December 2nd, 1909	February 17th.
Rees, Thomas John	October 20th, 1910 ...	December 1st.
Rele, Gangaram Rajendrarao	,, ,, ,,	,, ,,
Ridgway, Joseph	,, ,, ,,	,, ,,
Robinson, James Beglar	,, ,, ,,	,, ,,
Rose, John George	May 5th, 1910.....	June 16th.
Russell, John	January 20th, 1910...	February 17th.
Sen, Aswini Kumar	January 20th, 1910...	February 17th.
Sen, Rajendra Nath	November 3rd, 1910	December 1st.
Shah, Motilal Kashalchand	March 3rd, 1910	May 5th.
Sharpe, Frederick Herbert	October 20th, 1910 ...	December 1st.
Sinclair, St. Clair Overbeck	May 5th, 1910	June 16th.
Slade, Roland Edgar	April 21st, 1910	,, ,,
Smith, Ernest William	January 20th, 1910...	February 17th.
Smith, James Harry	April 21st, 1910	June 16th.
Smith, Percy Lancelot James	October 20th, 1910 ...	December 1st.
Smith, Thomas May	April 21st, 1910	June 16th.
Smith, William James Pittock	June 16th, 1910.....	December 1st.

Name.	Proposed.	Elected.
Sorabji, Kaikhushroo Bamanji	May 26th, 1910	June 16th.
Southgate, Herbert William	November 18th, 1909	February 17th.
Srivastava, Jwala Prasad	October 20th, 1910	December 1st.
Stedman, Ernest	May 26th, 1910	June 16th.
Stuart, Murray	January 20th, 1910	February 17th.
Temperley, Claude Vareille	June 16th, 1910	December 1st.
Terrey, Augustus George	October 20th, 1910	,, ,,
Thole, Ferdinand Bernard	April 21st, 1910	June 16th.
Tschugaeff, Leo	June 16th, 1910	December 1st.
Turbutt, Richard Babington	,, ,, ,,	,, ,,
Turner, Joseph	October 20th, 1910	,, ,,
Vance, John Fleming Culun Brown	November 17th, 1910	December 1st.
Wallis, Robert Lauder Mackenzie	October 20th, 1910	December 1st.
Ward, Percy George	January 20th, 1910	February 17th.
Williams, Arthur Bernard	November 3rd, 1910	December 1st.
Williams, Frederick George	April 21st, 1910	June 16th.
Williams, Herbert Goulding	June 16th, 1910	December 1st.
Williams, John	May 26th, 1910	June 16th
Wolfenden, Stuart Jardine Norris	November 18th, 1909	February 17th.
Wright, William Norman Stewart	June 16th, 1910	December 1st.
Young, John	January 20th, 1910	February 17th.
Yusuf, Syed Muhammad	October 20th, 1910	December 1st.

LIST OF FELLOWS DECEASED DURING 1910.

Name.	Elected.	Died.
Abegg, Richard	December 6th, 1906	April 3rd, 1910.
Barklie, Robert	December 1st, 1870	May 27th, 1910.
Benn, Robert Haslam Durward	May 5th, 1904	April 4th, 1910.
Blackburn, Thomas	October 2nd, 1886	March 10th, 1910.
Brown, James Campbell	March 7th, 1907	March 14th, 1910.
Bull, Benjamin Samuel	February 1st, 1898	July 4th, 1910.
*Cannizzaro, Stanislao	June 19th, 1862	May 10th, 1910.
Carteighe, Michael	June 16th, 1864	May 30th, 1910.
Croysdale, John	June 20th, 1895	March 11, 1909.
*Fittig, Rudolf	February 1st, 1883	November 19th, 1910.
Grundy, Frank Barnes	December 3rd, 1903	October 18th, 1910.
Guttmann, Oscar	December 2nd, 1897	August 2nd, 1910.
Hadley, Edwin Bernard	December 1st, 1898	August 26th, 1908.
*Landolt, Hans	February 2nd, 1888	March 14th, 1910.
Mackay, Angus	December 2nd, 1877	February 8th, 1910.
Palmer, Sir Walter, Bart.	April 17th, 1879	April 16th, 1910.
Phillips, Arthur Gaved	February 1st, 1887	April 17th, 1910.
Roberts, Richard Wightwick	April 4th, 1889	April 6th, 1910.
Udall, Thomas Bertram	April 6th, 1876	December 24th, 1909.
White, John Tsawoo	April 4th, 1889	1910.
Williams, Charles Hanson Greville	January 16th, 1862	July 15th, 1910.

* Honorary and Foreign Member.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY DURING 1910.

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January 20th.		
1. The alkaloids of ergot. Part II. By George Barger and Arthur James Ewins	2	284
2. The constituents of colocynth. By Frederick Belding Power and Charles Watson Moore	3	99
3. Organic derivatives of silicon. Part XII. Dibenzylethylpropylsilicane and sulphonic acids derived from it. By Frederick Challenger and Frederic Stanley Kipping	3	142
4. Formation of heterocyclic compounds. Part II. Action of bases on the *aa'*-dibromo-derivatives of certain dicarboxylic acids. By Henry Rondel Le Sueur and Paul Haas	4	173
5. The triazo-group. Part XI. Substituted triazomalonic and phenyltriazoacetic acids. By Martin Onslow Forster and Robert Müller	4	126
6. Iodobenzenemonosulphonic acids. Part II. Esters and salts of di- and tri-iodobenzenesulphonic acids. By Mary Boyle	4	211
7. The absorption spectra of naphthalene and of tetramethylnaphthalene. By Annie Homer and John Edward Purvis	5	280
8. The influence of various substituents on the optical activity of tartramide. Part III. Halogen-substituted anilides. By Percy Faraday Frankland and Douglas Frank Twiss	5	154
9. The action of water of crystallisation on calcium carbide. By Irvine Masson	6	851
10. Decomposition of dimercurammonium nitrite by heat. By Prafulla Chandra Rây and A. C. Ghosh	6	323
11. The adsorption of uranium-*X* by barium sulphate. By Arthur John Berry	6	196
12. Experiments on the Walden inversion. Part III. Optically active β-hydroxy-β-phenylpropionic acids and the corresponding β-bromo-β-phenylpropionic acids. By Alex. McKenzie and Herbert Brooke Perren Humphries	7	121
13. The double nitrites of mercury and the metals of the alkaline earths. By Prafulla Chandra Rây	7	326
14. The resin acids of the Coniferae. Part II. Matairesinol. By Thomas Hill Easterfield and James Bee	7	1028
15. Note on the supposed permeability of glass. By Alfred Vincent Elsden	7	—

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16. 3 : 5-Dichloro-*o*-phthalic acid. By Arthur William Crossley and Gertrude Holland Wren	8	98
17. A new dilution law. (Preliminary note.) By James Riddick Partington	8	—
18. 2-Phenyl-1 : 3-benzoxazine-4-one. By Arthur Walsh Titherley	9	200
19. The intramolecular rearrangement of diphenylamine ortho-sulphoxides. Part II. By Edward de Barry Barnett and Samuel Smiles	10	186
20. The effect of contiguous unsaturated groups on optical activity. Part IV. Conjugated systems containing more than two unsaturated groups. By Sydney Robert Edminson and Thomas Percy Hilditch	10	223
21. The alkaloids of the Pukatea. By Bernard Cracroft Aston	11	1381
22. The Friedel-Crafts' reaction applied to naphthalene. Part I. Syntheses with di- and tri-alkyl halides. By Annie Homer	11	1141
23. The Friedel-Crafts' reaction applied to naphthalene. Part II. The action of acetylene tetrachloride and of acetylene tetrabromide. Preparation of $\alpha\beta\alpha'\beta'$-dinaphthanthracene. By Annie Homer	12	1141
February 3rd.		
24. Cupri-compound : citrates, tartrates, acetates. By Spencer U. Pickering	17	1837
25. The constitution of basic salts. By Spencer U. Pickering	19	1851
26. The constituents of red clover flowers. By Frederick Belding Power and Arthur Henry Salway	20	231
27. The influence of radium emanation on equilibrium in a gaseous system. By Francis Lawry Usher	20	389
28. *iso*Quinoline derivatives. Part IV. Ortho-dihydroxybases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines into 3 : 4-dihydroxyphenylethylalkylamines. By Frank Lee Pyman	21	264
29. The action of chlorine on phenylcarbamide. By Frederick Daniel Chattaway and Newcomb Kinney Chaney	22	292
30. Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid. By Frederick Daniel Chattaway and Frederick Alfred Mason	22	339
31. A natural substantive dyestuff. By Arthur George Perkin	23	220
32. Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides. By George Senter	23	346
33. Strychnine, berberine, and allied alkaloids. By William Henry Perkin, jun., and Robert Robinson	24	305

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34. Δ^1-Nonylenic acid. By Victor John Harding and Charles Weizmann	24	299
35. The constitution of the amidines. A new method for determining molecular symmetry. By Julius Berend Cohen and Joseph Marshall	24	328
36. The half-life period of radium; a correction. By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.	25	185
37. The absorption spectra of dinaphthanthracene and its hexahydro-derivative compared with the absorption spectra of its isomerides. By Annie Homer and John Edward Purvis	25	1155
38. Apparatus for demonstrating the electrolysis of hydrochloric acid. By Augustus Edward Dixon and John Taylor	25	374
39. The relation between reactivity and chemical constitution of certain halogen compounds. By Hans Thacher Clarke	26	416
40. The action of lithium and calcium on organic halides. By James Frederick Spencer and Gwynnedd Mary Price	26	385
41. The change of cobaltous into cobaltic nitrite. By Tsuneo Suzuki	27	726
42. The solubility of potassium sulphate in concentrated aqueous solutions of non-electrolytes. By John Jacob Fox and Arthur Josiah Hoffmeister Gauge	27	377
43. The triazo-group. Part XII. Derivatives of para-triazobenzaldehyde. By Martin Onslow Forster and Hilda Mary Judd	28	254
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44. Attempted resolution of racemic aldehydes. By William Ord Wootton	43	405
45. The influence of colloids and fine suspensions on the solubility of gases in water. Part I. Solubility of carbon dioxide and nitrous oxide. By Alexander Findlay and Henry Jermain Maude Creighton	44	536
46. The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures. By John Edward Purvis	45	692
47. Absorption spectra and melting-point curves of aromatic diazoamines. By Clarence Smith and Constance Hamilton Watts	45	562
48. Synthesis of *dl*-narcotine (gnoscopine). Preliminary note. By William Henry Perkin, jun., and Robert Robinson	46	—
49. Isomeric chromous chlorides. By William Arthur Knight and Elizabeth Mary Rich	47	87*
50. The chromous chlorides. By William Arthur Knight	47	

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51. Silver amalgams. By Chapman Jones	47	336
52. Derivatives of *S*-phenylphenazothionium. Part III. By Edward de Barry Barnett and Samuel Smiles ...	47	362
53. The vapour pressures of two perfectly miscible solids and their solid solutions. By Ernest Vanstone	47	429
March 3rd.		
54. Phenomena observed when potassium mercuri-iodide is dissolved in ether and water. By James Ernest Marsh	50	2297
55. The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory. By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden	51	571
56. Action of ethyl cyanoacetate on 5-chloro-1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one. By Arthur William Crossley and Charles Gilling	53	518
57. The constitution of carpaine. Part I. By George Barger	53	466
58. Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate. By Alex. McKenzie and Henry Wren	54	473
59. The colour and constitution of azo-compounds. Part V. By John Theodore Hewitt and Ferdinand Bernard Thole	54	511
60. The direct union of carbon and hydrogen at high temperatures. Part II. By John Norman Pring.....	55	498
61. Affinity relations of cupric oxide and of cupric hydroxide. By Arthur John Allmand	55	603
62. 3-Aminoquinoline and the colour of its salts. By William Hobson Mills and Walter Henry Watson ...	56	741
63. The absorption spectra of *p*-toluidine, *m*-xylidine, and of their condensation products with acetaldehyde. By John Edward Purvis	56	644
64. A supposed case of stereoisomeric tervalent nitrogen compounds. By Humphrey Owen Jones and Edward John White	57	632
65. The isolation of stable salt hydrates, with special reference to the stable hydrates of sodium carbonate. By Alexander Charles Cumming.....	57	593
66. Salts and ethers of 2 : 3 : 5-trinitro-4-acetylaminophenol. By Raphael Meldola and Harold Kuntzen.....	58	444
67. The interaction of hydrogen and chlorine. The inhibitive effect of ozone and chlorine dioxide. (Preliminary note.) By David Leonard Chapman and Patrick Sarsfield MacMahon	58	—
68. Diketodiphenylpyrroline and its analogues. Part III. By Siegfried Ruhemann	59	462
69. Triphenyl-2-pyrone. By Siegfried Ruhemann.....	59	457

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70. The solubility of organic acids and bases in solutions of their salts. (Preliminary note.) By Nevil Vincent Sidgwick	60	—
71. 1 : 4-Dichloroanthraquinone and its derivatives. By Gertrude Maud Walsh and Charles Weizmann	61	685
72. The synthesis of Δ^1-*cyclo*penteneacetic acid and of 1-methyl-Δ^2-*cyclo*hexene-3-acetic acid. By Victor John Harding and Walter Norman Haworth	61	486
73. Solubilities below and above the critical temperature. By Dan Tyrer	62	621
March 17th.		
74. Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group. By Frederick Challenger and Frederic Stanley Kipping	65	755
75. The rate of hydration of acetic anhydride. By Albert Cherbury David Rivett and Nevil Vincent Sidgwick.	66	732
76. The colour and ionisation of cupric salts. By Nevil Vincent Sidgwick and Henry Thomas Tizard	67	957
77. Some new metallic carbonyls. By the late Ludwig Mond, Heinrich Hirtz, and Matthewman Dalton Cowap	67	798
78. Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphorcarboxylic acid and its derivatives. By Thomas Martin Lowry, Cecil Henry Desch, and Herbert William Southgate	68	899
79. Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor. By Thomas Martin Lowry and Herbert William Southgate	68	905
80. The action of aromatic amines on ethyl malonate. By Frederick Daniel Chattaway and James Montrose Duncan Olmsted	69	938
81. Synthesis of dipeptides of lauric and *n*-nonoic acids. Products of the condensation of lauric and *n*-nonoic acids with glycine, alanine, and leucine. (Preliminary note.) By Arthur Hopwood and Charles Weizmann	69	—
82. The densities and molecular weights of neon and helium. By Herbert Edmeston Watson	70	810
83. The molecular weights of krypton and xenon. By Herbert Edmeston Watson	70	833
84. Studies in the diphenyl series. Part I. Acetylation of benzidine derivatives. By John Cannell Cain and Percy May	71	720
85. Additive compounds of *s*-trinitrobenzene with arylamines. Combination as affected by the constitution of the arylamine. By John Joseph Sudborough and Stanley Hoskings Beard	71	773

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April 21*st*.		
86. Tetranitroaniline. By Bernhard Flürscheim and Theodor Simon	81	—
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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 365.

Thursday, January 20th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society in the death of Mr. Edmund Alfred Pontifex (elected on December 4th, 1848), which took place on November 12th, 1909.

It was announced also by the PRESIDENT that the Council desired to invite Past President Professor William Odling, who was elected a Fellow of the Society early in 1848, to the dinner at which it was proposed to entertain the Past Presidents who have completed fifty years of Fellowship. Professor Odling was one of the Past Presidents whose Jubilee was celebrated in 1898.

Messrs. A. C. G. Egerton, H. R. Ellis, W. C. McC. Lewis, and R. V. Norris were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Herbert Arthur Berens, Sidney Sussex College, Cambridge.

Arthur James Child, Oaklands, Edgware.

Reginald Henry Cocks, M.A., 14, Norbiton Avenue, Kingston Hill, Surrey.

Leonard Harry Cooper, 524, Fulham Palace Road, Fulham, S.W.

Bernard Okes Coventry, 24, Bolingbroke Grove, Wandsworth Common, S.W.

Benjamin Leslie Emslie, Glengairn, Oakville, Ontario.

John Handley, P.O. Box 247, New Liskeard, Ontario.

Walter Hayhurst, B.Sc., Tremellen Street, Accrington.
Leslie Charles W. Jenkins, 31, Eastcombe Avenue, Charlton, Kent.
Hans Krall, B.A., Trinity College, Dublin.
John Herbert Lavender, 27, Parade Street, Barrow-in-Furness.
Alexander Marcan, Royal Mint, Bangkok, Siam.
George Williams Neal, B.Sc., 8, Little Park Gardens, Enfield.
Philip Brady Nicholson, 2, Silverwood Terrace, Thrybergh, Rotherham.
Gilbert Palmer, B.Sc., 17, Wansbeck Gardens, West Hartlepool.
Clifford Clare Rattey, 37, Park Avenue, Swinton, near Manchester.
John Russell, B.A., "Oaklands," Carsick Hill, Tom Lane, Sheffield.
Aswini Kumar Sen, B.A., B.Sc., 81/82, Harrison Road, Calcutta.
Ernest William Smith, 20, St. Bevan's Road, Halifax.
Murray Stuart, B.Sc., 27, Chowringhee, Calcutta.
Percy George Ward, B.Sc., The Lodge, Preston Park, Brighton.
John Young, Highfield, Stanley Road, Teddington.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Eduard Buchner, Ph.D., Burgstrasse 8, Breslau I.
Malur Srinivasa Rau, M.A., M.D., B.Sc., Bangalore, India.

Of the following papers, those marked * were read:

*1. "The alkaloids of ergot. Part II."
By George Barger and Arthur James Ewins.

Ergotoxine (Barger and Carr, *Trans.*, 1907, **91**, 337) has now been shown to possess a carboxyl group; ergotinine, its anhydride, is probably a lactone. When ergotinine is warmed with a dilute solution of phosphoric acid in absolute alcohol, the crystalline *phosphate* of *ergotoxine ethyl ester*, $C_{34}H_{40}O_4N_5{\cdot}CO_2Et,H_3PO_4$, is formed. This new base is amorphous; it differs from ergotoxine in being insoluble in dilute sodium hydroxide, and in yielding a series of salts having a different crystalline form from that of the corresponding ergotoxine salts.

It is probable that the ester is also formed to some extent when ergotinine and ergotoxine are heated with alcohol in the absence of acids. The fall of optical rotation of alcoholic ergotinine solutions has been examined.

On destructive distillation, both of ergotinine and of ergotoxine, a small quantity of a crystalline sublimate is formed, which has been identified as *iso*butyrylformamide, $CHMe_2{\cdot}CO{\cdot}CO{\cdot}NH_2$; a new synthesis of this substance was described.

***2. "The constituents of colocynth."**
By Frederick Belding Power and Charles Watson Moore.

The material employed in this investigation was Turkish colocynth, consisting of the dried, peeled fruit of *Citrullus Colocynthis*, Schrader. The pulp of the fruit represented 24·4 per cent. of the whole. An alcoholic extract of the pulp, on distillation with steam, yielded a small amount of an essential oil. From the portion of the extract which was soluble in water there were isolated a new dihydric alcohol, $C_{22}H_{36}O_2(OH)_2$ (m. p. 285—290°), designated as *citrullol*, and an amorphous, alkaloidal principle, which possesses strongly purgative properties. The aqueous liquid contained, furthermore, a quantity of inorganic material, a little sugar, and a very small amount of an amorphous, glucosidic substance. The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it there were isolated a considerable quantity of α-elaterin (m. p. 232°; $[\alpha]_D$ −68·9°); small amounts of hentriacontane, $C_{31}H_{64}$, and a phytosterol, $C_{27}H_{46}O$ (m. p. 160—162°, optically inactive); a mixture of fatty acids, and a little of the above-mentioned alkaloidal principle. None of the constituents of the resin were glucosidic, but the portions extracted by ether and chloroform possessed purgative properties. No evidence could be obtained of the presence of β-elaterin.

The seeds of the colocynth, which represented 75·5 per cent. of the entire peeled fruit, contained traces of an alkaloidal principle, a small amount of an enzyme, and yielded 12·72 per cent. of fatty oil. From the latter there was isolated a small amount of a phytosterol, $C_{20}H_{34}O$ (m. p. 158—160°; $[\alpha]_D$ +8·1°).

The results of the present investigation have led to the conclusion that the so-called "colocynthin" and "colocynthitin," which have previously been recorded as constituents of colocynth, consisted of mixtures of a very indefinite character.

***3. "Organic derivatives of silicon. Part XII. Dibenzylethylpropylsilicane and sulphonic acids derived from it." By Frederick Challenger and Frederic Stanley Kipping.**

With the object of obtaining an optically active compound containing only one asymmetric silicon atom, the authors have prepared *dibenzylethylpropylsilicane*, $SiEtPr(CH_2Ph)_2$, by the interaction of benzylethylpropylsilicyl chloride and magnesium benzyl chloride; and also more conveniently, by the interaction of dibenzylethylsilicyl

chloride and magnesium propyl bromide. It is a colourless liquid, boiling at 262—265°/90 mm. The dl-*monosulphonic acid*,

$$CH_2Ph{\cdot}SiEtPr{\cdot}CH_2{\cdot}C_6H_4{\cdot}SO_3H,$$

is produced together with a *disulphonic acid*, probably

$$SiEtPr(CH_2{\cdot}C_6H_4{\cdot}SO_3H)_2,$$

when the silicohydrocarbon is treated with chlorosulphonic acid in chloroform solution. The separation of these acids is accomplished with the aid of their strychnine or *l*-menthylamine salts.

The resolution of the *dl*-monosulphonic acid has been effected, and the details will be communicated later.

***4. "Formation of heterocyclic compounds. Part II. Action of bases on the *aa'*-dibromo-derivatives of certain dicarboxylic acids." By Henry Rondel Le Sueur and Paul Haas.**

cis-Tetrahydrofuran-2 : 5-dicarboxylic acid and muconic acid are formed by the interaction of alcoholic potassium hydroxide and *aa'*-dibromoadipic acid, m. p. 192—193°. Ethyl 1-phenylpyrrolidine-2 : 5-dicarboxylate is the main product formed on heating together diethylaniline and ethyl *aa'*-dibromoadipate; ethyl muconate is also formed in small amount, and during the course of the reaction a considerable quantity of ethyl bromide is evolved.

The action of aniline and of ethylaniline on ethyl *aa'*-dibromosuccinate and of aniline on ethyl *aa'*-dibromosebacate has been investigated, but in these cases no cyclic compound analogous to those mentioned above is produced.

5. "The triazo-group. Part XI. Substituted triazomalonic and phenyltriazoacetic acids." By Martin Onslow Forster and Robert Müller.

With the purpose of observing further the effect of environment on the behaviour of the triazo-group, the properties of substituted triazomalonic acids have been studied.

Methyltriazomalonic, *ethyltriazomalonic*, and *phenyltriazomalonic acids* with their *esters* and *amides* have been prepared, and also the *ethyl* ester and *amide* of *bistriazomalonic acid*, and the substances subjected to comparison with the corresponding derivatives of triazoacetic and *phenyltriazoacetic* acids.

6. "Iodobenzenemonosulphonic acids. Part II. Esters and salts of di- and tri-iodobenzenesulphonic acids." By Mary Boyle.

Ethyl and *methyl* esters of 2 : 5-, 3 : 5-, 2 : 4-, and 3 : 4-*di-iodobenzenesulphonic*, and of 3 : 4 : 5-, 2 : 4 : 5-, and 2 : 3 : 5-*tri-iodobenzene-*

sulphonic acids have been prepared and studied. The accumulation of iodine in the nucleus considerably reduces the stability of the sulphonic ester, the tri-iodo-derivatives being readily hydrolysed by water and by alcohol.

The *sodium*, *potassium*, and *ammonium* salts of 2 : 4- and 3 : 5-di-iodo- and of 3 : 4 : 5-, 2 : 4 : 5-, and 2 : 3 : 5-tri-iodobenzenesulphonic acids have been prepared and investigated with regard to water of crystallisation and to solubility. Experiments on the electrical conductivities of the acids have also been carried out, the results of which, however, will be communicated later.

7. "The absorption spectra of naphthalene and of tetramethylnaphthalene." By Annie Homer and John Edward Purvis.

The absorption curves for both *N*/1000- and *N*/10-solutions of the hydrocarbon, $C_{14}H_{16}$ (*Trans.*, 1908, **93**, 1319), are similar to the curves for naphthalene. They confirm the previous suggestion that the hydrocarbon is a tetramethylnaphthalene.

The observations of Baly and Tuck (*Trans.*, 1908, **93**, 1902) with regard to the presence of bands corresponding with $1/\lambda$ 3125 and $1/\lambda$ 3220 in naphthalene and its derivative are confirmed.

Hartley represented the naphthalene curve for dilute solutions as being characterised by four narrow bands. Baly and Tuck consider that their broad band $1/\lambda$ 3700 corresponds with Hartley's four bands. The curves obtained by the present authors for *N*/1000-solutions of naphthalene and of its tetramethyl derivative show four narrow bands, and these observations support Hartley's first interpretation.

8. "The influence of various substituents on the optical activity of tartramide. Part III. Halogen-substituted anilides." By Percy Faraday Frankland and Douglas Frank Twiss.

In continuation of the work of one of the authors on the connexion between chemical constitution and optical activity, and more especially on the effect on rotatory power exercised by substituting hydrogen in the amido-groups of tartramide (see *Trans.*, 1903, **83**, 1342, 1349; 1906, **89**, 1852), the preparation and properties of the three chloro- and three bromo-anilides of tartaric acid were described. The *m*-iodo-anilide, which will be more fully described later, has also been compared as regards its rotation with the other halogen-anilides. The relation between the optical activity of these compounds and that of tartranilide and of the tartarotoluidides was discussed.

9. "The action of water of crystallisation on calcium carbide." By Irvine Masson.

It was shown that on mixing excess of powdered calcium carbide with powdered crystalline hydrates, generation of acetylene takes place with great velocity, in some cases at laboratory temperature, in others at higher temperatures. The volume of gas can, after standardisation, be used as a measure of the amount of dehydration.

Of twenty-two hydrated salts examined, many are rendered anhydrous, whilst others form stable lower hydrates, some of which have not previously been recorded.

When ammonium salts are dehydrated with calcium carbide, it is found that in most cases no ammonia is liberated, even at 160°, and in spite of the presence of calcium hydroxide. Crystalline acids and acid salts do not react as acids on the carbide or hydroxide.

10. "Decomposition of dimercurammonium nitrite by heat." By Prafulla Chandra Rây and A. C. Ghosh.

When its temperature is slowly raised to 250°, dimercurammonium nitrite, NHg_2NO_2, decomposes, with the production of mercury, oxygen, nitrogen, and nitrous oxide. The volume of the nitrogen is about twice that of the nitrous oxide. The oxygen is quite small in quantity, but never wanting. Nitric oxide is entirely absent, except when the salt has been rapidly heated. The principal decomposition, expressed by the equation: $NHg_2NO_2 = N_2 + 2HgO$, resembles that of ammonium nitrite into nitrogen and water. The equation $NHg_2NO_2 = N_2O + Hg + HgO$ represents another mode of decomposition.

11. "The adsorption of uranium-*X* by barium sulphate." By Arthur John Berry.

Determinations of the adsorption of uranium-*X* by barium sulphate have been made by precipitating the barium sulphate in solutions of uranyl nitrate in radioactive equilibrium, measurements being made of the β-ray activity of the precipitate. It has been found that the quantity $\frac{\log(a-x)}{\log x/m}$ is a constant, where a is the initial amount of uranium-*X*, x the amount adsorbed, and m the mass of barium sulphate adsorbing it. The value of the constant depends on various conditions, chiefly on the dilution and on the amount of sulphuric acid. Other things being equal, dilution and excess of sulphuric acid favour adsorption.

12. "**Experiments on the Walden inversion. Part III. Optically active β-hydroxy-β-phenylpropionic acids and the corresponding β-bromo-β-phenylpropionic acids.**" **By Alex. McKenzie and Herbert Brooke Perren Humphries.**

The resolution of inactive β-hydroxy-β-phenylpropionic acid into its optically active components was described. The displacement of the hydroxy-group in these acids by bromine has been studied, and also the displacement of bromine by the hydroxy-group in the corresponding active bromo-acids.

13. "**The double nitrites of mercury and the metals of the alkaline earths.**" **By Prafulla Chandra Rây.**

The author has used the general method of preparation of the double nitrites of mercury and the alkali metals (*Trans.*, 1907, **91**, 2031) in order to obtain similar double nitrites of mercury and the alkaline earths.

The following salts were described: *mercuric calcium nitrite*, $Hg(NO_2)_2,Ca(NO_2)_2,5H_2O$; *mercuric strontium nitrite*, $3Hg(NO_2)_2,2Sr(NO_2)_2,5H_2O$, and *mercuric barium nitrite*, $3Hg(NO_2)_2,2Ba(NO_2)_2,5H_2O$.

14. "**The resin acids of the Coniferae. Part II. Matai-resinol.**" **By Thomas Hill Easterfield and James Bee.**

The heart resin of the "Matai" tree (*Podocarpus spicatus*) consists chiefly of a crystalline substance, $C_{19}H_{20}O_6$, isomeric with the pino-resinol obtained by M. Bamberger from the exudation-resin of *Pinus laricio* and *Picea vulgaris*. Both compounds contain two methoxy- and two hydroxy-groups. *Matairesinol* is a lactone; it melts at 119°, and has $[\alpha]_D$ −4·89°. The *lactonic acid*, *disulphonic acid*, and *acetyl* and *benzoyl* derivatives were described.

15. "**Note on the supposed permeability of glass.**" **By Alfred Vincent Elsden.**

C. Zengelis (*Zeitsch. physikal. Chem.*, 1909, **65**, 341) describes experiments in which the vapours of various substances appeared to pass through glass at the ordinary temperature. In one of his experiments, silver foil was placed on the outside of a sealed flask containing iodine, the whole being placed in an air-tight vessel. The silver showed distinct signs of attack in three days. Zengelis considers that there was a real loss of weight in Landolt's experiments,

due to the loss of vapours through the glass walls of the containing vessels. On the other hand, Landolt himself has drawn a contrary conclusion.

Since, according to Zengelis, iodine vapour can pass through glass with such readiness, it should be possible to detect a progressive loss of weight of a sealed glass vessel containing iodine. In order to test this, some iodine was placed in a small-thin walled glass tube of about 2 mm. diameter, formed by drawing out a test-tube, the tube being then sealed up in the blowpipe flame. It was cleaned and placed in a box containing silver leaf to absorb any iodine vapour which might pass through the glass. This tube was carefully weighed from time to time during nine months, but no loss of weight could be detected.

The weights observed were :

Gram :								
0·15331	0·15330	0·15329	0·15332	0·15332	0·15332	0·15333	0·15332	0·15331
Date :								
20/3/09	22/3/09	28/3/09	19/4/09	1/8/09	2/3/09	29/8/09	4/9/09	20/12/09

In another experiment, a sealed glass tube containing iodine was sealed within a larger glass tube containing silver leaf. At the end of nine months the silver leaf showed no signs of attack. Since these experiments were started, A. Stock and H. Heynemann (*Ber.*, 1909, **42**, 1800) have published the result of a similar experiment, but have not confirmed Zengelis' observations, which are probably the result of imperfect sealing or the presence of minute cracks and bubbles in the glass.

16. "3 : 5-Dichloro-*o*-phthalic acid."
By Arthur William Crossley and Gertrude Holland Wren.

3 : 5-Dichloro-*o*-phthalic acid has been synthesised from 3 : 5-dinitro-*o*-xylene as a starting point, and its properties have been compared with those of the acid obtained by Crossley and Le Sueur (*Trans.*, 1902, **81**, 1533) from the product of the action of phosphorus pentachloride on dimethyldihydroresorcin, with the result that the two acids have been proved identical (compare Villiger, *Ber.*, 1909, **42**, 3529).

17. "A new dilution law." (Preliminary note.)
By James Riddick Partington.

Ostwald's dilution formula, $\alpha^2/(1-\alpha)v = constant$, assumes that ionisation is spontaneous in the same sense as the thermal dissociation of a gas. In the ionisation of a gas by Röntgen rays, etc., the rapidly

moving ion exerts great influence on the ionisation of molecules in its path. Larmor has made a passing suggestion that a similar influence may be exerted by ions in solutions of electrolytes. This leads to the equation : $a^2/(v + Ka)(1 - a) = constant$, K being a new constant. This is found to be in quantitative agreement with the data for potassium, lithium, sodium and ammonium chlorides, lithium, sodium and silver nitrates, and potassium iodide, all of which show marked deviations from Ostwald's formula. The following examples illustrate this :

(1) Potassium chloride in aqueous solution at 18°.

K	= 0·018	0·015	0·016	0·017	0·016
K^1	= 0·0239	0·0235	0·0337	0·0652	0·1025

K = constant calculated by the new formula, K^1 is that calculated by Ostwald's formula.

(2) Silver nitrate in aqueous solution at 18°.

K	= 0·0062	0·0059	0·0061	0·0068
K^1	= 0·0089	0·0088	0·0115	0·0216

18. "2-Phenyl-1 : 3-benzoxazine-4-one."

By Arthur Walsh Titherley.

The unsaturated cyclic compound $C_6H<^{CO\cdot N}_{O-C\cdot Ph}$ (*2-phenyl-1 : 3-benzoxazine-4-one*) has been synthesised from phenyl salicylate and phenylbenzamidine. At 110° phenol is eliminated, forming the tautomeric compound *salicylphenylbenzamidine* (I and II), which by reversible decomposition yields aniline and the cyclic compound (IV), probably through the intermediate third tautomeric form (III) :

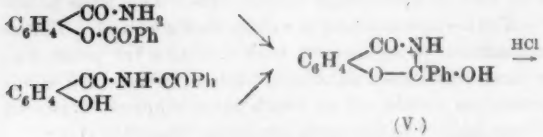
$$C_6H_4<^{CO\cdot OPh}_{OH} + \overset{NH_2}{\underset{CPh:NPh}{|}} \rightarrow$$

$$C_6H_4<^{CO\cdot NH}_{OH\ CPh:NPh} \text{ (I.)} \rightleftharpoons C_6H_4<^{CO-N}_{OH\ CPh\cdot NHPh} \text{ (II.)}$$

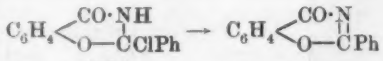
$$C_6H_4<^{CO\cdot N}_{O-CPh} \text{ (IV.)} \xleftarrow{-NH_2Ph} C_6H_4<^{CO\cdot NH}_{O-CPh\cdot NHPh} \text{ (III.)}$$

The same unsaturated cyclic compound (IV) has also been obtained by the catalytic action of hydrogen chloride on *O*- and *N*-benzoyl-salicylamides between 110° and 140 by removing the water as it is produced. The unstable 2-hydroxy- and 2-chloro-dihydrobenzoxazone

derivatives (V and VI) appear to be formed as intermediate compounds which cannot be isolated.



(V.)



(VI.)

2-Phenyl-1 : 3-benzoxazine-4-one melts at 106°, and possesses marked additive properties. It is comparatively stable towards aqueous alkalis, but is rapidly decomposed in presence of hydrogen ions, combining with water with formation of the *N*-benzoylsalicylamide, through the intermediate compound (V). Aniline is similarly added, yielding the above salicylphenylbenzamidine (I and II) in yellow needles melting at 106°, but the reaction is reversible, and the amidine derivative readily loses aniline on heating, with production of 2-phenyl-1 : 3-benzoxazine-4-one.

19. "The intramolecular rearrangement of diphenylamine ortho-sulphoxides. Part II." By Edward de Barry Barnett and Samuel Smiles.

N-Methyldiphenylamine *o*-sulphoxide is converted into the azothionium salt without loss or rearrangement of the methyl group. Hence with the imino-sulphoxides the reaction does not involve the direct migration of hydrogen from the imino- to the thionyl group. In this reaction the sulphoxide salts are formed as initial products, and it is these substances which are converted into the azothionium derivatives. The process which the sulphoxide salts undergo in the final stage of the reaction cannot be conclusively determined, but the alternative hypotheses: (*a*) elimination of water, or (*b*) migration of hydroxyl, afford a satisfactory explanation of the change.

20. "The effect of contiguous unsaturated groups on optical activity. Part IV. Conjugated systems containing more than two unsaturated groups." By Sydney Robert Edminson and Thomas Percy Hilditch.

The change of rotatory power on successively increasing the number of adjacent unsaturated groups attached to an optically active system has been studied in the cases of phenolic derivatives (of the type of

o-hydroxybenzylideneacetone, etc.) and naphthyl (2-aceto- and 2-benzo-*a*-naphthol) esters of camphoric and camphor-β-sulphonic acids. An approximation to the normal rotatory power of esters of these acids has been obtained by examination of their ethyl, *n*-propyl, and *n*-butyl derivatives.

Both series of hydrogen camphorates show accompanying increase of molecular rotatory power with increasing number of unsaturated groups, but the camphor-β-sulphonates are less definite.

Combining these results with various data which previous work has rendered it possible to collate, it is found that of eleven available series, four show a progressive increase, four a progressive decrease, and the remaining three indefinite relations to the optical activity of the corresponding compound containing two contiguous unsaturated radicles.

No generalisation is therefore possible, but it is noticeable that practically all these unsaturated compounds possess rotatory powers greater than the normal value of saturated derivatives.

21. "**The alkaloids of the Pukatea.**" **By Bernard Cracroft Aston.**

The Pukatea (*Laurelia novæ Zealandiæ*) has been found to contain three alkaloids, namely: *pukateine*, $C_{17}H_{17}O_3N$, which is crystalline, melts at 200°, and has $[\alpha]_D - 220°$; *laureline*, $C_{19}H_{21}O_3N$, which is amorphous, but forms well crystallised salts; and *laurepukine*, $C_{16}H_{18}O_3N$, which is also amorphous.

The physiological action of pukateine (in the form of its hydrochloride) resembles that of strychnine, but is not so intense.

22. "**The Friedel-Crafts' reaction applied to naphthalene. Part I. Syntheses with di- and tri-alkyl halides.**" **By Annie Homer.**

The Friedel-Crafts' reaction with naphthalene proceeds according to two equations:

$$RH + R_1Cl = RR_1 + HCl \quad (1)$$
$$RH + RH = RR + 2H \quad (2).$$

Both reactions occur simultaneously, but if the reaction is initiated at a high temperature, then the relative velocity of (2) is so much greater than that of (1) that there is a complete preponderance of the products of reaction (2) over those of reaction (1).

The work was confined to the study of the action of ethylidene chloride, methylene chloride, ethylene bromide, and chloroform on naphthalene.

It was found that the reaction proceeded primarily according to

reaction (1) in the case of ethylidene chloride, ethylene bromide, and chloroform, although the products finally isolated were those due to secondary reactions taking place. In the case of methylene chloride the only products which could be obtained were those in accordance with reaction (2), as it was not possible to work under conditions favourable to reaction (1).

23. "The Friedel-Crafts' reaction applied to naphthalene. Part II. The action of acetylene tetrachloride and of acetylene tetrabromide. Preparation of $\alpha\beta\alpha'\beta'$-dinaphthanthracene." By Annie Homer.

From among the products of the action of acetylene tetrachloride and acetylene tetrabromide on naphthalene in presence of aluminium chloride there has been isolated a substance melting at 267·5°, and having the formula $C_{22}H_{14}$. This hydrocarbon is identical with a substance obtained by Dewar and Jones by the action of nickel carbonyl on naphthalene (*Trans.*, 1904, **85**, 212), but which had not been investigated by them. The formation of the substance by these two reactions, which in the benzene series yield anthracene derivatives, together with the ease with which the hydrocarbon can be reduced to a hexahydride, point to its being $\alpha\beta\alpha'\beta'$-dinaphthanthracene. The melting point of the compound, its persistent colour, the colour of its sulphuric acid solution, and the melting point of its quinone and picrate all show that it is not the same dinaphthanthracene as that prepared by Hartenstein (*Diss.*, Jena, 1892), which, from the mode of formation, must have the $\beta\beta\beta'\beta'$-configuration.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vols. II. ii., and III. i. pp. xxviii + 497 to 1101, 478. ill. Wien 1910. (*Recd.* 5/1/10.)
From the Publishers: Messrs. Urban and Schwarzenberg.

Blacher, *C.* Feuerungstechnisches. pp. iv + 104 + 7. Riga 1909. (*Recd.* 21/12/9.) From the Publisher: N. Kymmel.

Crookes, *Sir William.* Diamonds. pp. xvi + 146. ill. London 1909. (*Recd.* 11/1/10.) From the Author.

Lewkowitsch, *Julius*. Technologie et analyse chimiques des huiles, graisses et cires. Traduit . . . par *Émile* **Bontoux**. Vol. III. pp. xi + 1425 to 1973. ill. Paris 1910. (*Recd.* 17/1/10.) From the Author.

Stewart, *Alfred Walter*. Recent advances in physical and inorganic chemistry. pp. xiv + 267. London 1909. (*Recd.* 19/1/10). From the Author.

Woburn Experimental Fruit Farm. Eleventh report. By the **Duke** of **Bedford** and *Spencer U.* **Pickering**. pp. v + 191 + [xxii]. London 1910. (*Recd.* 10/1/10.) From the Authors.

II. *By Purchase.*

Herz, *W.* Der Verteilungssatz. Mit einer Zusammenstellung der wichtigsten Verteilungskoeffizienten zwischen flüssigen Schichten. (Sammlung, Vol. XV.) Stuttgart 1909.

Wieland, *Heinrich*. Die Knallsäure. (Sammlung, Vol. XV.) Stuttgart 1909.

III. *Pamphlets.*

Dalton, *Leonard V.* On the origin of petroleum. (From *Economic Geology*, 1909, 4.)

Hooper, *David*. The composition of Indian rice. (From the *Agricultural Ledger*, 1908–09, No. 5.)

Lauder, *Alexander*, and **Fagan**, *T. W.* The variation in the composition of milk. Fourth annual report on the work at Rosslynlee, 1908–09. pp. 38. Edinburgh 1909.

Mackenzie, *J. Ross*. Brewing and malting waters. pp. 23. Worcester 1909.

JULIUS THOMSEN MEMORIAL LECTURE.

The Julius Thomsen Memorial Lecture will be delivered by Professor Sir EDWARD THORPE, C.B., F.R.S., at the Ordinary Scientific Meeting on Thursday, February 17th, 1910, at 8.30 p.m.

PRESENTATION TO PROFESSOR KOERNER.

A Committee has been formed in Milan with the object of celebrating the seventieth birthday of Professor Koerner. It is proposed to devote subscriptions to the following purposes:

1. Foundation of a prize for work in pure and applied chemistry.
2. Reprinting Professor Koerner's works.
3. Presentation of a gold medal to Professor Koerner.

The Treasurer of the Chemical Society will be glad to receive subscriptions, and will forward them to the Organising Committee.

BLOCKS OF DIAGRAMS.

The Council has decided to dispose of all the blocks of diagrams, etc., which have appeared in the Journal or Proceedings prior to the year 1904, and Fellows are notified that these blocks may be had if application be made to the Assistant Secretary before February 28th, 1910. A small charge will be made to cover cost of looking out the blocks, and postage.

At the next Ordinary Scientific Meeting on **Thursday**, February 3rd, 1910, at **8.30** p.m., the following papers will be communicated:

"Cupric compounds: citrates, tartrates, and acetates." By S. P. U. Pickering.

"The constitution of basic salts." By S. P. U. Pickering.

"The action of chlorine on phenylcarbamide." By F. D. Chattaway and N. K. Chaney.

"Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid." By F. D. Chattaway and F. A. Mason.

"The constituents of red clover flowers." By F. B. Power and A. H. Salway.

"A natural substantive dyestuff." By A. C. Perkin.

"The influence of radium emanation on equilibrium in a gaseous system." By F. L. Usher.

"Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides." By G. Senter.

"Strychnine, berberine, and allied alkaloids." By W. H. Perkin and R. Robinson.

"*iso*Quinoline derivatives. Part IV. Ortho-dihydroxy-bases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines into 3 : 4-dihydroxyphenylethylalkylamines." By F. L. Pyman.

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[*Issued* 12/2/10.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 366.

Thursday, February 3rd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, F.R.S., President, in the Chair.

Messrs. A. J. Ewins and H. T. Tizard were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Herbert Edmund Clarke, B.Sc., 20, Grosvenor Road, Jesmond, *Newcastle-on-Tyne.*

William Jacob Jones, B.Sc., Queen's Terrace, Llanrwst.

Frederick Charles Lewis, 20, Eskburn Road, Liverpool.

Hubert Leslie Lucking, Ph.D., St. Mary's, West Heath Road, Hampstead, N.W.

Of the following papers, those marked * were read:

*24. "Cupri-compounds: citrates, tartrates, acetates."

By Spencer U. Pickering.

The constitution suggested for the cupric carbonates has been confirmed by a study of the citrates, of which eleven have been isolated or recognised. They are derived from the potassiocupric citrate, $(C_6H_5O_7)_2K_4Cu$, the copper becoming electronegative by union with two carbons, and also quadrivalent. The β-salt contains

$$M^{I}OHOC\cdot Cu^{IV}O\cdot CO_2$$

(in which case it is alkaline), or $Cu^{II}O_2C\cdot Cu^{IV}O\cdot CO_2$, resulting from the

union of potassium hydroxide or cupric oxide with the double citrate. More potash converts the $:Cu^{IV}O$ into $:Cu^{IV}OHOK$, the substance becoming violet, oxidising dextrose, and combining with cellulose. This is the γ-salt. The α-salt is produced from the double salt and an alkaline carbonate, the elements of potassiocupric carbonate becoming added to the former. The double salt dissolves to form a β-cupri-salt with $(HO)_2C{\cdot}Cu^{IV}O{\cdot}CO_2$: this obviates having to regard the former as a molecular compound. A similar explanation applies to the acetates.

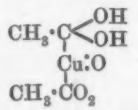
Hydroxides of the alkali metals with copper tartrate first form a neutral β-cupritartrate, containing $(HO)_2C{\cdot}Cu^{IV}O{\cdot}CO_2$, and also a $:Cu^{IV}O$ group between each pair of CHOH groups. Excess of alkali converts these into the $:Cu^{IV}OHOK$ groups of the γ-salt.

All γ-salts decompose, giving cupric or cuprous oxides: a γ-cupri-dextrose, with a $:Cu^{IV}OHOK$ group between each pair of carbons, would explain the proportion of copper reduced by dextrose.

Discussion.

Mr. E. H. Jeffers remarked that as regards the citrate known as Luff's salt, no other formula than the one now put forward by Mr. Pickering seemed to him to account for the strongly alkaline nature of that particular compound.

Mr. Tizard said he would like to know how copper acetate would ionise if it really had the formula Mr. Pickering suggested, namely:



Mr. Pickering had said that solutions of copper acetate differed from those of other copper salts in having a deeper colour, and in depositing copper hydrate at high concentrations. But a deep colour was not an exclusive property of the acetate; all copper salts of weak acids had a more or less deep colour in solution—the weaker the acid the deeper being the colour. Again, the deposition of hydrate merely meant that hydrolysis of the salt was so great that at high concentrations the solution became supersaturated with regard to the hydrolytic product. He thought there was no reason why the ordinary formula for copper acetate should be given up.

Sir W. Ramsay said that three professedly new, but really old, forms of combination had been adduced by Mr. Pickering. First, linked oxygen in , that we probably knew in hydrogen dioxide; secondly, copper as tetrad, that we knew in "real" potassium

cuprate, K_2CuO_3, a red substance; and lastly, copper in direct union with carbon, that was known in copper acetylide. The cupritartrates did not display the property of hydrogen dioxide, or of a cuprate, or of copper acetylide.

Mr. PICKERING said that in the case of the carbonates it was evident that the only alternative to the copper atom being united to oxygen, as in compounds with electropositive copper, was to leave it united with the carbon. That the cupricarbonates on electrolysis were found to contain an electronegative copper ion had been demonstrated by Wood and Jones, and the same had been proved as regards the cupritartrate by Masson and Steele. No novelty attached to the idea of copper being able to act as a tetrad, being electronegative or being directly united to carbon; but it was quite fallacious to argue that, because this latter form of union obtained in copper acetylide, which was explosive, all compounds exhibiting such a union must be explosive too. There were other reasons, quite apart from the union of the copper and carbon, to account for the explosiveness of copper acetylide. Similarly, it could not be argued that the group $=C<\begin{matrix}O\\O\end{matrix}$ would be unstable, because $\begin{matrix}H-O\\H-O\end{matrix}$ was so; for the latter, in decomposing, formed an exceptionally stable substance, with a large evolution of heat.

The formulæ suggested for the acetates removed the difficulties presented of explaining the differences exhibited between these substances and ordinary copper salts. That suggested for the composition of cupridextrose (the existence of which could not be questioned) agreed exactly with the amount of copper yielded by it, and could not be discredited because it indicated the formation of formaldehyde; for, as a matter of fact, formic acid was, according to Claus, one of the products of its decomposition and oxidation.

***25. "The constitution of basic salts." By Spencer U. Pickering.**

Additional evidence of the individuality of the five basic salts formed by the action of lime on copper sulphate was given, and it was shown that whilst the lower members are true basic salts, the higher members contain electronegative copper, and show all the properties of cupri-compounds; they also contain calcium oxide and calcium sulphate. The extreme members of the series are simply cuprates of calcium. A simple scheme was suggested which seems to give a full explanation of the constitution and various properties of the compounds.

Iron appears to form analogous compounds, namely, ferrates, with the metal in the electronegative condition.

***26. "The constituents of red clover flowers." By Frederick Belding Power and Arthur Henry Salway.**

The flowers of the common red clover (*Trifolium pratense*, Linné), which are used to some extent medicinally, have been subjected to a complete chemical examination.

A quantity of the alcoholic extract, representing 37·1 kilograms of the dried flowers, when distilled with steam yielded 10·5 grams, or 0·028 per cent., of essential oil. This essential oil, which contained furfuraldehyde, possessed the following constants: $d\ 20°/20 = 0·9476$; $\alpha_D + 4°0'$ in a 1-dcm. tube.

The portion of the alcoholic extract which was soluble in water contained a large amount of sugar, which yielded *d*-phenylglucosazone (m. p. 205°), but from the aqueous liquid the following definite substances were isolated: salicylic and *p*-coumaric acids; *iso*rhamnetin, $C_{16}H_{12}O_7$ (m. p. 295°), which was probably present in the form of a glucoside; a number of new phenolic substances: *pratol*,

$$OH·C_{15}H_8O_2·O·CH_3$$

(m. p. 253°), which apparently is a hydroxymethoxyflavone; *pratensol*, $C_{17}H_9O_2(OH)_3$ (m. p. 210°); a yellow *compound*, $C_{16}H_{10}O_7$ (m. p. 280°); a *substance*, $C_{15}H_7O_3(OH)_3$ (m. p. 225°); a *substance*, $C_{14}H_{12}O_6$ (m. p. 214°); also the following new glucosides: *trifolin*, $C_{22}H_{22}O_{11},H_2O$ (m. p. 260°), which yields on hydrolysis a yellow colouring matter, *trifolitin*, $C_{16}H_{10}O_6$ (m. p. 275°), and rhamnose; iso*trifolin*, $C_{22}H_{22}O_{11}$ (m. p. 250°), and a glucoside of quercitin, melting at 235°.

The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it the following compounds were obtained: myricyl alcohol, $C_{31}H_{63}·OH$; heptacosane, $C_{27}H_{56}$, and hentriacontane, $C_{31}H_{64}$; sitosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D - 34·4°$); a new dihydric alcohol, *trifolianol*, $C_{21}H_{34}O_3(OH)_2$ (m. p. 295°); a mixture of fatty acids, and a small amount of pratol, $C_{16}H_{12}O_4$, the latter having evidently been present in the resin in the form of a glucoside.

***27. "The influence of radium emanation on equilibrium in a gaseous system." By Francis Lawry Usher.**

A quantitative study of the pressure changes following the introduction of radium emanation into ammonia and mixtures of nitrogen and hydrogen, coupled with analysis of the resulting mixture of gases, lead to the following conclusions:

(1) Ammonia is decomposed rapidly at the ordinary temperature, and solid ammonia less rapidly at −190°.

(2) This decomposition is nearly irreversible, and re-combination of nitrogen and hydrogen was not observed to take place to a greater extent than 0·86 per cent.

(3) At the ordinary temperature the decomposition follows approximately the course of a unimolecular homogeneous reaction when correcting factors for the decay of the emanation, and alteration of its efficiency with time, are introduced.

(4) The maximum effect observed was the decomposition of 134,300 molecules of ammonia per atom of emanation. The energy required to produce this effect is about one per cent. of the energy actually expended during its production.

(5) If the ratio of ammonia to emanation molecules does not exceed 10,000 to 1, the statement that each atom in disintegrating produces the same effect is not strictly true, on account of the waste involved when the system is rich in emanation.

(6) All experiments with gases in glass vessels in presence of the emanation are complicated by the fact that gas is driven into the glass, and can only be recovered by heating strongly in a vacuum.

***28. "*iso*Quinoline derivatives. Part IV. Ortho-dihydroxy-bases. The conversion of 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*-quinolines into 3 : 4-dihydroxyphenylethylalkylamines." By Frank Lee Pyman.**

A number of ortho-dihydroxy-bases have been prepared by the action of hot concentrated hydrochloric acid under pressure on certain 6 : 7-dimethoxy*iso*quinoline derivatives described in the previous papers of this series. None of those in which the *iso*quinoline ring was preserved had any marked physiological action, but the 1-keto-6 : 7-dimethoxy-2-alkyltetrahydro*iso*quinolines gave rise to 3 : 4-dihydroxyphenylethylalkylamines, bases of very considerable pressor properties.

Discussion.

Dr. Hewitt suggested that the anhydride obtained from dihydroxydihydro*iso*quinoline methiodide by the action of alkalis possibly possessed a quinonoid instead of a phenol-betaine structure. Substances of undoubted phenol-betaine constitution behaved as the phenoxides of powerful bases, dissolving in water to give alkaline solutions (for example, the anhydride of *o*-hydroxyphenyltrimethylammonium hydroxide : Griess, *Ber.*, 1880, **13**, 246).

Further, A. E. Dunstan, J. J. Fox, and J. T. Hewitt had shown that the coloured methiodides of hydroxy- and amino-substituted acridines (hydroxy- or amino-group in the para-position to the meso-

carbon atom) yield nearly colourless carbinol bases, which when heated give intensely coloured anhydrides.

Dr. PYMAN replied that the compound in question had the characteristic properties of phenol-betaines mentioned by Decker and Dunant (*Annalen*, 1908, **358**, 296); amongst others, that of forming the methoxy-derivative of the *iso*quinolinium iodide when heated with methyl iodide.

29. "The action of chlorine on phenylcarbamide." By Frederick Daniel Chattaway and Newcomb Kinney Chaney.

Since each of the three hydrogen atoms attached to nitrogen in the compound can be exchanged for halogen, which can also pass into the nucleus, the action of chlorine on phenylcarbamide is a complicated one. The isolation of the various *N*-chloro-derivatives is rendered difficult, and in some cases impracticable, by the circumstance that the conditions under which the group ·CO·NHCl is stable bring about the transformation of the group ·NCl·C_6H_5.

Owing to the group ·CO·NHCl breaking down with liberation of nitrogen in presence of alkali bicarbonates, chlorination has to be effected in acid solution, and consequently *N*-chloro-derivatives containing the unsubstituted phenyl residue, although undoubtedly formed, have not been isolated in a pure state. An account was given of the preparation and properties of a large number of the theoretically possible *N*-chloro-derivatives of *p*-chloro-, 2 : 4-dichloro-, and 2 : 4 : 6-trichloro-phenylcarbamide.

30. "Halogen derivatives of malonanilide, ethyl malonanilate, and malonanilic acid." By Frederick Daniel Chattaway and Frederick Alfred Mason.

The halogen derivatives of malonanilide and of ethyl malonanilate are produced together when ethyl malonate in some excess is heated for a short time with the corresponding aniline, and can easily be separated owing to the sparing solubility of the anilides in all ordinary solvents.

The halogen substituted malonanilic acids are obtained by hydrolysing the corresponding substituted malonanilic esters. When heated they decompose quantitatively into carbon dioxide and the similarly substituted acetanilides, thus, for example:

$$C_6H_2Cl_3\cdot NH\cdot CO\cdot CH_2\cdot CO_2H = CO_2 + C_6H_2Cl_3\cdot NH\cdot CO\cdot CH_3.$$

The compounds containing chlorine and bromine in the 4-, 2 : 4-, and 2 : 4 : 6-positions were described.

31. "A natural substantive dyestuff." By Arthur George Perkin.

The material known as the "red dura" of the Soudan consists of the leaf sheaths and stem of a variety of the *Andropogon sorghum* or "Great Millet." In dyeing property it closely resembles sanderswood (*Pterocarpus santalinus*), giving with unmordanted wool a dull red shade, but this is rendered more permanent when a chromium or copper mordant is employed. The colouring matter, $C_{16}H_{12}O_5$, which, owing to its similarity to santalin, is called *dura-santalin*, forms a scarlet, crystalline powder, soluble in alkalis with a violet-red coloration. On fusion with alkali it yields phloroglucinol and *p*-hydroxybenzoic acid.

32. "Reactivity of the halogens in organic compounds. Part IV. Interaction of bromoacetic, α-bromopropionic, and α-bromobutyric acids and their sodium salts with silver salts in aqueous solution. Catalytic action of silver halides." By George Senter.

The reactions in question are mainly bimolecular, but are complicated by various disturbing causes. The results of the kinetic experiments with silver nitrate at 26° are summarised in the accompanying table, in which the numbers in the second and fifth lines represent the velocity-coefficients. In order to reduce them to a concentration of one mol. per litre, they must be multiplied by 600.

$CH_2Br{\cdot}CO_2H$.	$CHMeBr{\cdot}CO_2H$.	$CHEtBr{\cdot}CO_2H$.
0·0000055	0·00055	0·0025
[1]	[100]	[450]
$CH_2Br{\cdot}CO_2Na$.	$CHMeBr{\cdot}CO_2Na$.	$CHEtBr{\cdot}CO_2Na$.
0·000016	0·0025	0·0060
[3]	[450]	[1100]

The numbers in brackets give the relative reactivities of the compounds, referred to the slowest as unity.

The silver bromide precipitated in the course of the reactions exerts a powerful accelerating influence on the velocity. Even 1/1000 molar silver bromide (mainly present in the insoluble form) may double the speed of a reaction. Silver iodide exerts a similar catalytic influence on the reaction between silver nitrate and methyl iodide in aqueous solution. These observations appear to account for some hitherto unexplained results obtained by previous observers.

Nitric acid and benzenesulphonic acid greatly retard the rate of reaction between silver nitrate and bromopropionic acid; lactic acid has a much smaller effect. The rate of reaction is not greatly affected by replacing half the solvent water by alcohol and by acetone respectively.

33. "Strychnine, berberine, and allied alkaloids." By William Henry Perkin, jun., and Robert Robinson.

The constitution of strychnine and brucine and their derivatives was discussed in detail, and a modification of the usually accepted formula of berberine was suggested.

34. "Δ^1-Nonylenic acid." By Victor John Harding and Charles Weizmann.

A description was given of the methods of preparation of Δ^1-nonylenic acid, its derivatives, and means of identification.

35. "The constitution of the amidines. A new method for determining molecular symmetry." By Julius Berend Cohen and Joseph Marshall.

H. v. Pechmann (*Ber.*, 1895, **28**, 869) stated that the amidines obtained (I) from benzanilide imidochloride and *p*-toluidine, and (II) from benzoyl-*p*-toluidide imidochloride and aniline, were identical, and that on ethylation a mixture of two ethyl derivatives was produced, corresponding with the replacement of the H* by C_2H_5 in the two formulæ:

$$\underset{\text{(I.)}}{NPh{:}CPh{\cdot}N\overset{*}{H}{\cdot}C_7H_7} \qquad \underset{\text{(II.)}}{C_7H_7{\cdot}N{:}CPh{\cdot}N\overset{*}{H}Ph.}$$

Where the bases differed in character, however, the amidines obtained by the two methods were still identical, but methylation produced only one methyl derivative, indicating a fixed structure for the original amidine.

The present investigation was undertaken to determine whether the introduction of optically active groups into the amidine would offer a more delicate means of distinguishing between the products of the two reactions in the event of their being indistinguishable by other means. *l*-Menthylamine was used in the earlier experiments as the active base, and the other bases taken were aniline, the three toluidines, and ethylamine. The several amidines were prepared by the two methods, and it was found that they were in each case absolutely identical as regards specific rotation and other physical properties. Furthermore, by ethylation it was shown that the amidines were in no case mixtures, but definite compounds in which the mobile hydrogen atom was attached to the less basic group.

Finally, an amidine was prepared in which the two bases used, namely, *d*- and *l*-bornylamine, were enantiomorphous. In this case it

was found that the product was inactive, showing that it is probably a mixture of the two amidines in equal quantities. The ethylation product was also inactive. Attempts to resolve the simple amidine and the ethyl derivative into active constituents by fractional crystallisation of the *d*-camphorsulphonate were unsuccessful.

36. "The half-life period of radium; a correction." By Robert Whytlaw Gray and Sir William Ramsay, K.C.B.

The half-life period of radium deduced from the volume of emanation yielded by 1 gram of the element in radioactive equilibrium was erroneously given as 1258 years (*Trans.*, 1909, **95**, 1082). The correct value of this constant, calculated from the published experimental data, is 1744 years.

37. "The absorption spectra of dinaphthanthracene and its hexahydro-derivative compared with the absorption spectra of its isomerides." By Annie Homer and John Edward Purvis.

The results of this investigation are: (1) the spectroscopic evidence supports the proposition that the hydrocarbon, $C_{22}H_{14}$ (m. p. 267·5°), is a dinaphthanthracene compound, and that its hydride, $C_{22}H_{20}$, no longer contains an anthracene linking.

(2) Hartenstein's substance is not a dihydrodinaphthanthracene, but a dinaphthanthracene isomeric with both the dinaphthanthracene compound (m. p. 267·5°) and picene.

(3) The origin of the differences in the absorption bands of the above four compounds may be explained by a consideration of the differences in the anthracene linkings and in the angular or linear linkings of the rings.

38. "Apparatus for demonstrating the electrolysis of hydrochloric acid." By Augustus Edward Dixon and John Taylor.

The electrolysis is performed in a large, vertical U-tube, into the limbs of which two arc-light carbon rods are plunged.

From near the top of each limb, a short delivery tube passes off horizontally; by means of these tubes the electrolytic gases are led into the measuring vessel, which contains concentrated sulphuric acid. The latter vessel consists of a three-limbed tube of special construction, one of the limbs serving to control the pressure, while the other two receive and measure the hydrogen and the chlorine.

A method was described for staining the sulphuric acid, and thus

rendering visible, at a greater distance than usual, the collection of the gases. The construction of the apparatus is such as to preclude leakage of the electrolyte, and to admit of ready access for the purpose of cleaning.

39. "The relation between reactivity and chemical constitution of certain halogen compounds." By Hans Thacher Clarke.

The reactivity towards alcoholic pyridine of the halogens (X) in a series of compounds of the type $X \cdot CH_2 \cdot R$ has been studied, the group (R) being varied in each case. It was shown that the reactivity of the halogen is controlled by the residual affinity of the atom or group (R), and a dynamic formula for the carboxyl group was suggested.

40. "The action of lithium and calcium on organic halides." By James Frederick Spencer and Gwynnedd Mary Price.

Calcium and lithium react with organic halides on heating in a manner analogous to that observed in the interaction of magnesium and organic halogen derivatives (*Trans.*, 1908, **93**, 68).

In the case of calcium, the reaction proceeds along two lines, as indicated by the equations:

$$R \cdot X + Ca = R \cdot CaX\ ;\ 2R \cdot X + Ca = CaX_2 + R \cdot R.$$

The compounds R·CaX are decomposed readily by water, giving the parent substances of the original halide:

$$2R \cdot CaX + 2H_2O = 2R \cdot H + CaX_2 + Ca(OH)_2.$$

In ethereal solution, calcium reacts similarly to magnesium in the Grignard reaction. The yield of the products in these reactions rarely exceeds 40 per cent. of the theoretical amount. Lithium reacts much more readily than calcium on organic halides, with the production of lithium substitution products of the parent substance of the original halogen compound:

$$R \cdot X + 2Li = LiX + R \cdot Li.$$

The lithium derivatives are very unstable, and are immediately decomposed by water, yielding the parent substance of the halide used:

$$R \cdot Li + H_2O = R \cdot H + LiOH.$$

A second action takes place along with the formation of the lithium hydrocarbon, namely, the formation of compounds containing twice as many carbon atoms as the halide compound taken:

$$2R \cdot X + 2Li = 2LiX + R \cdot R.$$

The yields obtained in these reactions are generally very good, and vary from 80 per cent. of aniline in the case of *m*-chloroaniline to 8 per cent. of octane from *sec.*-octyl iodide.

41. "The change of cobaltous into cobaltic nitrite." By Tsuneo Suzuki.

In 1860, dark brownish-red crystals of very basic cobaltic nitrite were obtained by Lang, when he evaporated the solution left on mixing molecular quantities of cobalt sulphate and barium nitrite. Some years later, Hampe found that this crystalline, very soluble substance also contained cobaltous nitrite. It has now been quantitatively investigated. A straw-yellow silver salt and a potassium hydroxycobaltous hydroxycobaltinitrite have also been prepared. The composition of the silver salt is expressed by $Ag_3Co_2'''(NO_2)_6(OH)_3$, from which it follows that a double atom of cobalticum in this salt is combined, half as hydroxide and half as nitrite, with silver nitrite.

Lang's product, very soluble in water and alkaline to litmus, appears to correspond in composition with the silver salt, but to have cobaltous hydroxide and hydroxynitrite combined with the cobaltic hydroxide, thus :

$$3[Co_3''Co_2'''(NO_2)_9(OH)_3,Co''(NO_2)(OH)],2Co''(OH)_2,34H_2O = Co_{14}''Co_6'''(NO_2)_{20}(OH)_{16},34H_2O.$$

Of the change undergone by cobaltous nitrite, the primary product is probably $Co_4''Co_2'''(NO_2)_{10}(OH)_4$, as shown by the following equation :

$$6Co''(NO_2)_2 + 2H_2O = 2NO + 3Co''(NO_2)_2,Co_2'''(NO_2)_3(OH)_3,Co''(NO_2)(OH),$$

which then, by cumulative resolution, yields Lang's crystals and a salt in solution, probably $Co_3''Co_2'''(NO_2)_9(OH)_3$, analogous to the silver salt.

42. "The solubility of potassium sulphate in concentrated aqueous solutions of non-electrolytes." By John Jacob Fox and Arthur Josiah Hoffmeister Gauge.

The solubility of potassium sulphate at 25° in aqueous solutions of ethyl alcohol, ethylene glycol, glycerol, mannitol, sucrose, acetone, pyridine, and chloral hydrate was determined. It was observed that as the number of hydroxyl groups in the molecule of the non-electrolyte was increased, the precipitating effect on the potassium sulphate was decreased. The results were discussed from the point of view of the hydration of the non-electrolyte, and of the possible hydration of the ions derived from potassium sulphate. Jones and Getman's results as to the relative hydration of the non-electrolytes (*Amer. Chem. J.*, 1904, **32**, 308) were shown to be inadequate to account for the depression of solubility in the various solutions.

43. "The triazo-group. Part XII. Derivatives of para-triazobenzaldehyde." By Martin Onslow Forster and Hilda Mary Judd.

In the hope of explaining the peculiar change undergone by the potassium derivative of *p*-hydroxyphenylazoimide when a solution in alcohol or water is boiled, condensation products of *p*-triazobenzaldehyde with hydroxylamine, phenylhydrazine, *p*-aminophenol, and camphoryl-ψ-semicarbazide were studied, and the isomerism of the *p*-triazobenzaldoximes was investigated.

BLOCKS OF DIAGRAMS.

The Council has decided to dispose of all the blocks of diagrams, etc., which have appeared in the Journal or Proceedings prior to the year 1904, and Fellows are notified that they may obtain the blocks illustrating their own papers by applying to the Assistant Secretary before February 28th, 1910. A small charge will be made to cover cost of looking out the blocks, and postage.

At the next Ordinary Scientific Meeting on **Thursday**, February **17th**, 1910, at **8.30** p.m., Sir Edward Thorpe, F.R.S., will deliver the Julius Thomsen Memorial Lecture, and the following papers will be communicated:

"The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures." By J. E. Purvis.

"Absorption spectra and melting-point curves of aromatic diazoamines." By C. Smith and C. H. Watts.

"Synthesis of *dl*-narcotine (enoscopine). Preliminary note." By W. H. Perkin, jun., and R. Robinson.

"Isomeric chromous chlorides." By W. A. Knight and Miss E. M. Rich.

"The chromous chlorides." By W. A. Knight.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 17th, 1910.

Adams, Percival Frederick,

81, Rock Avenue, Gillingham, Kent.

Lecturer. Inter. B.Sc. (London). Science Lecturer under the Kent Education Committee at the Technical Institute, Gillingham. The chief reason for which admission to the Society is desired is that use may be made of the Society's publications and library.

T. Martin Lowry. A. N. Fitzgerald.
H. R. Redman. *H. F. Fermor.*
Sidney Harvey.

Auchinleck, Gilbert Grahame,

Basseterre, St. Kitts, B.W. Indies.

Science Master, St. Kitts-Nevis Grammar School. B.Sc. of McGill University, Montreal, Canada. Science Master, St. Kitts-Nevis Grammar School, from June 1st, 1908, to present date. Subsequently appointed Superintendent of Agriculture to Government of Grenada, W.I.

J. Wallace Walker. Francis Watts.
H. A. Tempany. *John R. Bovell.*
E. Gillman.

Banister, Fred,

The Grammar School, Doncaster.

Master at the Doncaster Grammar School. B.Sc. Second Class Honours in Chemistry, University of Wales. Formerly Master at the Grammar School, St. Anne's-on-Sea. Desirous of keeping in touch with the latest developments of Chemistry.

P. G. Mander. Allan Baguley.
Kennedy J. P. Orton. *C. R. Young.*
H. O. Jones. *W. J. Jarrard.*
R. Henry Jones. *W. E. S. Turner.*
Kenneth S. Caldwell.

Berens, Herbert Arthur,

Sidney Sussex College, Cambridge.

Exhibitioner. Taking Natural Science Tripos (Part II.) in Chemistry in 1911. Taking up Manufacturing Chemistry.

H. O. Jones. A. E. Bellars.
Charles T. Heycock. W. J. Pope.
H. O. Hale.

Canton, Howard,

"Lionsdale," 2, Gloucester Road, Regent's Park, N.W.

Student of Dentistry and Medicine. Student of Chemistry (Inorganic, Organic, and Analytical) for 5 years.

Ernest J. Parry. Hugh Candy.
John C. Umney. *Frank E. Weston.*
Walter Hibbert.

Child, Arthur James,

Oaklands, Edgware.

Student of Chemistry. Studying as B.Sc. Honours Student at University College, London. Have studied 3 years under Sir William Ramsay.

E. de Barry Barnett. N. T. M. Wilsmore.
H. Thacher Clarke. P. May.
Edward C. Cyril Baly. J. Norman Collie.
Samuel Smiles.

Cocks, Reginald Henry,

14, Norbiton Avenue, Kingston Hill, Surrey.

Science Master. Student at Oxford University, 1898–1902. Honours in Chemistry (M.A.). Science Master, Kingston Grammar School, 1903–1909. Lecturer in Chemistry, Kingston-on-Thames Polytechnic, 1909.

W. W. Fisher. N. V. Sidgwick.
T. S. Moore. A. F. Walden.
G. H. J. Adlam.

Cooper, Leonard Harry,

524, Fulham Palace Road, Fulham, S.W.

Analytical Chemist. Assistant to Mr. W. J. Dibdin, F.I.C., F.C.S., etc. Author of the paper: "Colorimetric Estimation of Bromine and Iodine in the presence of Chlorine." This paper will be read at the March meeting of the Society of Public Analysts.

W. J. Dibdin. J. C. Crocker.
J. L. White. J. Lewkowitsch.
J. B. Coleman. *J. Augustus Voelcker.*

Coventry, Bernard Okes,

24, Bolingbroke Grove, Wandsworth Common, S.W.; also Dehra Dun, U.P., India.

Deputy Conservator of Forests and Imperial Forest Chemist, Imperial Forest Service, India. The candidate has been deputed by the Government of India to study Chemistry with the object of qualifying for a post of Forest Chemist in India. Since appointed Imperial Forest Chemist from October 24th, 1909.

Harold Hartley. N. V. Sidgwick.
D. H. Nagel. Allan F. Walden.
R. W. Sindall.

Cumming, Alexander Charles,

39, Viewforth, Edinburgh.

Lecturer and Assistant in Chemistry in the University of Edinburgh. D.Sc. (Melbourne). Studied under Prof. Orme Masson, and carried out chemical research under Profs. Masson, James Walker, Richard Abegg, and Sir William Ramsay. Have published papers in *Trans. Chem. Soc.*, *Proc. Royal Society*, *Trans. Faraday Soc.*, and elsewhere.

Orme Masson. James Walker.
William Ramsay. Leonard Dobbin.
Sydney A. Kay.

Emslie, Benjamin Leslie,

Glengairn, Oakville, Ontario (Office: 1105, Temple Buildings, Toronto).

Agricultural Chemist and Manager in Canada of the educational propaganda work of the German Potash Syndicate. Holder of Diploma in Agriculture of Glasgow Agricultural College, and of Professional Associateship of the Surveyors' Institution, London; Member of the Royal Society of Arts, London; Fellow of the North British Academy of Arts; Member of the Society of Chemical Industry (Toronto Section); Member of the American Chemical Society. Formerly held position as Agricultural Chemist in the head offices of the German Potash Syndicate at Stassfurt, Germany. Author of "The Stassfurt Potash Salts," published in the *Journal of the Society of Chemical Industry*, under date of April 30th, 1909. Author of "Artificial Fertilisers: their Nature and Use," first published in *The Farmers' Advocate*, of London, Canada, during February and March, 1908. Translator of "On the Assimilation of the Elements of Nutrition by Plants during Different Periods of their Growth," being researches of the Ducal Agricultural Experiment

Station, Barnburg, Anhalt, Germany, and published by Vinton & Co., Ltd., London, E.C., in 1906.

W. R. Lang. W. H. Ellis.
W. Lash Miller. James McCutcheon.

R. A. Berry.

Everest, Arthur Ernest,

Clifton House, Shrewsbury.

Priestley Research Scholar, University of Birmingham. B.Sc., Birmingham. Priestley Research Scholar, 1908–09, and 1909–10.

Percy F. Frankland. Thos. J. Murray.
Alex. Findlay. C. K. Tinkler.
Hamilton McCombie. *Thomas H. Pope.*

Forster, Aquila,

156, Coatsworth Road, Gateshead-on-Tyne.

Prize Demonstrator in Chemistry at Armstrong College, Newcastle-on-Tyne. Bachelor in Science, Durham University. Author of "Note on Benzyl Ethyl Ether," in Proceedings of the Durham University Philosophical Society.

P. Phillips Bedson. F. C. Garrett.
J. A. Smythe. S. Hoare Collins.

Herbert Blair.

Handley, John,

P.O. Box 247, New Liskeard, Ontario, Canada.

Mining Engineer and Assayer. 1897: Part I and II Diploma in Agriculture, Cambridge. 1907: Elected Associate Member Canadian Soc. Civil Engineers; Member Canadian Mining Institute. 1897–1907: Assistant, and in charge, Assaying and various engineering works in Canada. 1907 to present time in private practice as Engineer and Assayer.

T. B. Wood. M. J. R. Dunstan.
R. A. Berry. John Golding.

J. F. Blackshaw.

Hayhurst, Walter,

Tremellen Street, Accrington.

Teacher. B.Sc. (Manchester University). Chief Science Lecturer and Demonstrator in the Pannal Ash College, Harrogate. Actively engaged in Chemical research.

Jas. Grant. L. G. Radcliffe.
Stanley J. Peachey. *F. S. Sinnatt.*
Fred. G. Richards. *E. L. Rhead.*

Hughes, Herbert Hillier,

22, Ranelagh Road, Tottenham, N.

Science Master (at Tottenham Grammar School). B.Sc. of London University; Chemistry taken at Final. Student of Chemistry at Stafford Technical School, and Mason Univ. Coll., Birmingham. Science Master (including Chemistry) for last six years.

R. Henry Jones. Arthur Adams.
A. B. Coles. *Allan Baguley.*
T. Slater Price.

Jaques, Arthur,

23, St. Oswin's Avenue, Cullercoats, Northumberland.

Student of Chemistry. B.Sc. (Dunelm). Published articles in *Chem. News*, Vol. 88 (295); Vol. 90 (107); Vol. 96 (77). Late Lecturer in Chemistry and Demonstrator in Physics, Magee College, Londonderry; late Fellow of Armstrong College, Newcastle-on-Tyne. Have done two years' research work in Electrochemistry under Professor Abegg, Breslau. Wish to take in the Journal and use the Library.

P. Phillips Bedson. S. Hoare Collins.
F. C. Garrett. Herbert Blair.
J. A. Smythe. John Watson.

Jenkins, Leslie Charles W.,

31, Eastcombe Avenue, Charlton, Kent.

English representative for Hard and Foreign wood importers. Studying Analytical Chemistry under Prof. Raphael Meldola. Specially working in dyeing woods, etc. Special investigation with reference to alloys, and general analytical work.

Thos. R. Duggan. B. S. Bull.
R. Meldola. *A. E. Bell.*
A. Harrison.

Krall, Hans,

Trinity College, Dublin.

Student. Senior Moderator (Experimental Science), B.A. (T. C. D.), 1908. Science Master, Rathmines College, 1908–09. Research Student, University Chemical Laboratory, T. C. D. (since 1909).

Sydney Young. Wm. C. Ramsden.
Emil A. Werner. Wm. Caldwell.
James H. Pollok.

Lavender, John Herbert,

27, Parade Street, Barrow-in-Furness.

Assistant Analyst, Vickers, Sons & Maxim, Naval Construction Works; also Lecturer in Chemistry and Metallurgy at Technical

School, Barrow-in-Furness. Late Staffordshire County Council Scholar in Metallurgy at Birmingham University, 1906–09. Formerly Demonstrator in Chemistry and Physics in West Bromwich Science School, and afterwards in the Municipal Secondary School. 3rd Stage Inorganic Chemistry and 3rd Stage Metallurgy (Board of Education Examinations). Full Technological Certificate, Iron and Steel Manufacture (City and Guilds Examinations).

Thomas Turner. T. Slater Price.
R. Lloyd Whiteley. Alex. Findlay.

W. J. Lancaster.

Lewis, Samuel Judd.

122, Newington Causeway, S.E.

Analytical and Consulting Chemist. Most important contributions to scientific literature are a Doktor Dissertation, and some half-dozen papers on Zirconium. Also a few papers to Pharmaceutical literature. B.Sc. (Lond.), F.I.C., Ph.C., Ph.D. (Tübingen). Have held appointment for 8 years as Analytical and Industrial Chemist. Now practising as Analytical and Consulting Chemist.

J. Norman Collie. William Ramsay.
A. G. Bloxam. Arthur R. Ling.

Samuel Smiles.

Marcan, Alexander,

Royal Mint, Bangkok, Siam.

Chief Assayer, Royal Mint, Bangkok, Siam. Associate of the Institute of Chemistry.

R. Meldola. S. B. Schryver.
M. O. Forster. William A. Tilden.

W. Gowland.

Meanwell, Charles Wright,

15, Woodlands Crescent, Muswell Hill Road, N.

Analytical Chemist at Messrs. Thos. De La Rue & Co., Ltd., 110, Bunhill Row, E.C. School training at Middle Class Schools, Cooper Street, E.C., under Prof. F. S. Barff. Three years' training at "Young" Chair of Technical Chemistry, Anderson's College, Glasgow, under Prof. E. J. Mills, F.R.S. (1879–1881). Joint paper with Prof. Mills on "The Action of Oxides on Salts. Part III" (*Journal of the Chemical Society*, Nov., 1881.) Two short notes contributed to "Handbook of the London Geological Field Class," 1891. Silver Medallist at examination of City and Guilds of London, 1881, on Oils, Colours, etc. Intermediate Examination for B.Sc., London, with Honours in Chemistry, 1882. Twenty-eight years as Chemist with

Messrs. De La Rue & Co., 21 of which under Dr. Hugo Müller, F.R.S. Elected F.I.C., 1887.

Hugo Müller. Edmund J. Mills.
Evelyn de la Rue. A. G. Perkin.
W. J. Cousins.

Murch, Douglas Wilshin,

Selby House, Victoria Road, Wednesbury, S. Staffs.

Chemist at Messrs. Chance & Hunt, Limited. Training: Manchester School of Technology; Messrs. Crace Calvert & Thomson, Analytical and Consulting Chemists, Manchester; University College, Liverpool (Languages). Experience: Assistant Chemist at Messrs. Lever Bros., Ltd. (5 years); Chemist at Messrs. Bowman, Thompson & Co., Ltd. (8 years); Chemist at Messrs. Brunner, Mond & Co., Ltd. (2 years); Chemist at Messrs. Chance & Hunt, Ltd. (7 years).

William Thomson. Edward Jackson.
Fredc. H. Bowman. Francis Henry Tate.
F. E. Bowman. *Alfred C. Fryer.*

Neal, George Williams,

8, Little Park Gardens, Enfield.

Lecturer in Chemistry and Mathematics at the Hackney Pupil Teachers' Centre, London, N.E. Bachelor of Science (Lond.). Lecturer in Chemistry at Hackney Pupil Teachers' Centre, and at Kingsland Science and Art Centre. I am anxious to have access to the Society's publications, and to be acquainted with the results of recent Chemical Research.

W. H. Collier. Frank E. Weston.
H. R. Ellis. Alfred Hyder.
W. H. Ratcliffe.

Nicholson, Philip Brady,

2, Silverwood Terrace, Thrybergh, Rotherham.

Analytical Chemist to Messrs. Simon-Carves, Ltd., Silverwood Colliery, Rotherham. Seven years Assistant Chemist, Messrs. Walter Scott, Ltd., Leeds Steel Works. Five years, studied Chemistry and Metallurgy at the Leeds School of Science. Two years and a-half, Analytical Chemist to Messrs. Simon-Carves Bye-product Coke Oven Construction and Working Co. Ltd., Silverwood Colliery, Rotherham.

R. Wells Varley. Samuel Parrish.
Harry W. Dixon. *W. Sudderick Brakes.*
Oswald F. Kirby.

Palmer, Gilbert,

17, Wansbeck Gardens, West Hartlepool.

Science Master. B.Sc. (Lond.), 1909 (Chemistry, Physics, and Mathematics). Engaged in teaching Chemistry since 1900 at "Organised Science School," Technical College, West Hartlepool, and at Elwick Road School, West Hartlepool.

James C. Philip. M. O. Forster.
G. T. Morgan. J. Archyll Jones.
J. W. Patterson.

Rattey, Clifford Clare,

37, Park Avenue, Swinton, near Manchester.

Electro-Chemist. Four years Student of East London College (University of London). Six years Analyst to the Electrical Power Storage Co., Ltd., London (Accumulator Manufacturers). Present position: Head Chemist to the Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester (Accumulator Manufacturers).

J. T. Hewitt. J. J. Fox.
F. G. Pope. *H. R. Le Sueur.*
Clarence Smith. *F. W. Caton.*

Rees, John James Beaumont,

Johannesburg College, S. Africa.

Schoolmaster. B.Sc. London (Chemistry). Desirous to keep in touch with the latest researches in Chemistry.

A. E. Dunstan. A. T. Cameron.
W. H. Mills. *F. Curzon Britten.*
W. Bradshaw Tuck.

Russell, John,

"Oaklands," Carsick Hill, Tom Lane, Sheffield.

Science Master (Sheffield Central Secondary School). Honours Degree in Chemistry (Oxford). Engaged in teaching Chemistry, and desirous of keeping in touch with chemical literature.

D. H. Nagel. N. Garrod Thomas.
N. V. Sidgwick. T. S. Moore.
Harold Hartley.

Sen, Aswini Kumar,

81/2, Harrison Road, Calcutta, India.

Dyer and Chemist. B.A. (Calcutta University: subjects of study being Chemistry, Physics, and Mathematics); B.Sc. Tech. (Victoria University, Manchester, in Applied Chemistry and Chemical Technology); also holder of the Diploma of the Municipal School

of Technology, Manchester, in Applied Chemistry and Chemical Technology.

Jas. Grant. L. G. Radcliffe.
Stanley J. Peachey. F. S. Sinnat.
E. L. Rhead.

Smith, Ernest William,
20, St. Bevan's Road, Halifax.

Head of the Pure and Applied Chemistry Department, Technical College, Halifax. Assistant Lecturer in Chemistry, Technical Schools, Hull, 1903–05. Head of the Chemistry Department, Technical College, Halifax, 1905—present time.

F. Stanley Kipping. Henry J. S. Sand.
R. M. Caven. William Cranfield.
R. Lyon.

Southgate, Herbert William,
130, Horseferry Road, Westminster, S.W.

Physics Lecturer, Westminster College, Horseferry Road, Westminster, S.W. B.Sc. (London). Engaged in Research Work on the Optical Properties of Organic Compounds.

T. Martin Lowry. Edward C. Cyril Baly.
George Senter. W. Bradshaw Tuck.
Frank Lee Pyman.

Stuart, Murray,
27, Chowringhee, Calcutta, India.

Assistant Superintendent, Geological Survey of India. B.Sc., Birmingham, in Geology and Chemistry. February–May, 1905, Acting Chemist to the Birmingham Corporation Gas Works. Publications: "Suitability of Sands in the Rajmahal Hills for Glass Manufacture," "Growth of Alunogen on a Meteorite," *Records Geol. Survey Ind.*, Vol. xxxvii, pt. 2, and "China-Clay and Fireclay Deposits in the Rajmahal Hills," *Rec. Geol. Sur. Ind.*, Vol. xxxviii, pt. 2, etc.

Percy F. Frankland. C. K. Tinkler.
Alex. Findlay. Hamilton McCombie.
Thos. J. Murray. *Edgar P. Hedley.*

Ward, Percy George,
The Lodge, Preston Park, Brighton.

Recently a Student of the Royal College of Science (Lond.); A.R.C.S. (Lond.); B.Sc. (Lond.).

William A. Tilden. G. T. Morgan.
M. O. Forster. J. C. Philip.
Chapman Jones.

Wolfenden, Stuart Jardine Norris,
The Grange, Sidcup, Kent.

Student. Commenced the study of Chemistry some 5 years ago in the laboratory of a Fellow (Mr. P. R. Sanders), and since have followed up the subject at various Public Institutions. Specially interested in Electrochemistry, and wish to keep in touch with literature and latest work on the subject. Going to Cambridge in about a year's time to take Science Tripos Course. Dr. Wolfenden, a past Fellow and well-known investigator in Physiological Chemistry (M.D. Cantab.).

P. R. Sanders.	*J. Connah.*
Frank E. Weston.	*T. J. Cheater.*
Cecil H. Cribb.	*Francis G. H. Tate.*

Young, John,
Highfield, Stanley Road, Teddington, Middlesex.

Analytical Chemist. Studied Chemistry for four years at the Glasgow and West of Scotland Technical College, and obtained the Diploma (A.G.T.C.). Passed the examinations for the Associateship of the Institute of Chemistry (A.I.C.). Employed as Assistant Chemist to Messrs. Thos. De La Rue & Co., Ltd., Manufacturing Stationers, etc.

G. G. Henderson.	William S. Denham.
William Dickson.	Evelyn de la Rue.
Thomas Gray.	*A. Campion.*

James C. Irvine.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I. (3):

Buchner, Eduard, Ph.D. (Munich).
Breslau I., Burgstrasse 8.

Professor at the University. Investigator of the fermentation without cells.

Prof. Albert Ladenburg.	Prof. Dr. Theodor Curtius (Heidelberg).
Prof. Dr. Rich. Abegg.	

Horace T. Brown.

Das, Tarak Nas,
31, Bhaironath, Benares City, India.

Chemical Assistant of Dr. Arthur Richardson, Central Hindoo College, Benares. Passed B.Sc. Examination, Allahabad University, in 1907. Has been Assistant in Practical Chemistry for 3 years

in the Central Hindu College, Benares, under Dr. Arthur Richardson. Has done independent research on "Reaction of Oxalates," which appeared in the *Chemical News* of June 25, 1909.

A. Sanyal. *Bidhu Bhushan Dutt.*

P. C. Rây.

McBeath, John William,

Kimberley, South Africa.

Chemist, Kimberley Mine Hospital. Passed the Pharmaceutical Society's Exam. in 1878. Chemist to Sir Wm. Gray & Co., West Hartlepool, 16 years. Chief Assayer to A. Davison's Executors, Kimberley, 1894 to 1898. Managing Partner of Albania Salt Works, Griqualand West, 1898 to 1901.

F. J. Pooler. *J. A. Wilkinson.*

Rau, Malur Srinivasa, M.A., M.D., B.Sc. (Edin.), D.P.H. (Cambridge).

Bangalore, South India.

Chemical Analyst and Bacteriologist to the Mysore Govt., Bangalore. Chemical Analyst for the last 13 years in Bangalore; formerly Professor of Chemistry, Doveton Protestant College, Madras. Worked in the Laboratories of the University of Edinburgh, University College, London, and of Mr. C. H. Cribb, Public Analyst, 136, Shaftesbury Avenue.

William Ramsay. Cecil H. Cribb.

Henry Kenwood. *Edward Bevan.*

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 25/2/10.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 367.

Thursday, February 17th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Mr. F. V. Darbishire was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Robert Benedict Bourdillon, Buddington, Midhurst, Sussex.
Charles Herbert Bell Longman, 32, Farringdon Street, Swindon.

A Certificate has been authorised by Council for presentation to ballot under Bye-law I. (3) in favour of Mr. Ettore Cardoso, D. ès Sc., 3, Grand Rue, Geneva.

It was stated that the following changes in the Officers and Council were proposed by the Council:

Vice-Presidents to retire.—Dr. J. J. Dobbie and Sir Alexander Pedler.

Hon. Secretary to retire.—Dr. M. O. Forster.

Ordinary Members of Council to retire.—Mr. A. Chaston Chapman, Dr. W. R. E. Hodgkinson, Dr. G. T. Morgan, and Prof. A. G. Perkin.

As President.—Prof. Harold B. Dixon.

As Vice-Presidents who have filled the Office of President.—Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J.

Emerson Reynolds, The Rt. Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Prof. Arthur W. Crossley and Dr. G. T. Morgan.

As Foreign Secretary.—Dr. Horace T. Brown.

As Vice-Presidents.—Dr. M. O. Forster and Prof. A. Liversidge.

As New Ordinary Members of Council.—Prof. Adrian J. Brown, Dr. A. McKenzie, Dr. J. C. Philip, and Sir Boverton Redwood.

Dr. J. A. Voelcker, Dr. V. H. Veley, and Dr. F. B. Power were elected Auditors to Audit the Society's Accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

Percival Frederick Adams.
Gilbert Grahame Auchinleck, B.Sc.
Fred Banister, B.Sc.
Herbert Arthur Berens.
Eduard Buchner, Ph.D.
Howard Canton.
Arthur James Child.
Reginald Henry Cocks, M.A.
Leonard Harry Cooper.
Bernard Okes Coventry.
Alexander Charles Cumming, D.Sc.
Tarak Nas Das, B.Sc.
Benjamin Leslie Emslie.
Arthur Ernest Everest, B.Sc.
Aquila Forster, B.Sc.
John Handley.
Walter Hayhurst, B.Sc.
Herbert Hillier Hughes, B.Sc.
Arthur Jacques, B.Sc.
Leslie Charles W. Jenkins.
Hans Krall, B.A.
John Herbert Lavender.
Samuel Judd Lewis, B.Sc., Ph.D.
Alexander Marcan.
John William McBeath.
Charles Wright Meanwell.
Douglas Wilshin Murch.
George Williams Neal, B.Sc.
Philip Brady Nicholson.
Gilbert Palmer, B.Sc.
Clifford Clare Rattey.
Malur Srinivasa Rau, M.A., M.D., B.Sc.
John James Beaumont Rees, B.Sc.
John Russell, B.A.
Aswini Kumar Sen, B.A., B.Sc.
Ernest William Smith.
Herbert William Southgate, B.Sc.
Murray Stuart, B.Sc.
Percy George Ward, B.Sc.
Stuart Jardine Norris Wolfenden.
John Young.

The PRESIDENT stated that he had been asked to call the attention of Fellows to a letter signed by Colonel Hime, Sir G. Greenhill and Mr. Oscar Guttmann, in which a proposal was outlined to erect a memorial to Roger Bacon.

The Julius Thomsen Memorial Lecture was delivered by SIR EDWARD THORPE, C.B., F.R.S., and at its conclusion SIR WILLIAM TILDEN, in proposing a vote of thanks, said everyone present would acknowledge that Sir Edward Thorpe had laid the Society under a new obligation for the interesting lecture just added to the long list of biographical notices with which he had enriched the pages of the Journal. With

regard to the subject of the lecture, he (the speaker) acknowledged that he had learned a great deal, because, although the four volumes of *Thermochemische Untersuchungen* occupied a prominent place on his book-shelves, he had been apt to forget that Thomsen's name should also be connected with other subjects. As to his laborious investigations in Thermal Chemistry, if it were admitted that we were still waiting for their complete interpretation, it should be remembered that every exact observation or experiment duly recorded would assist, sooner or later, in the progress of science. On this account Thomsen's name would long be held in honoured remembrance by the chemical world.

Professor JAMES WALKER said that to him, as to many another physical chemist, Julius Thomsen was merely a name, a great name it was true, but still only a name, one associated with certain numerals prefixed to the designation calories. He, therefore, personally owed sincere gratitude to Sir Edward Thorpe, not only for the excellent sketch he had given of Thomsen's wider activity in pure science, but also for his vivid presentation of Thomsen as a practical man, as a good citizen, and as a stout fighter—in short, as a human being. Similar feelings of gratitude must exist in the minds of all Fellows present, and he therefore had the greatest pleasure in seconding the vote of thanks to Sir Edward Thorpe for his admirable address.

The PRESIDENT was glad to say that Julius Thomsen was something more than a name to him, for it was his good fortune, some twenty-seven years ago, to catch the Professor in his laboratory, and he possessed and treasured a specimen of cryolite given him by Julius Thomsen. In putting the resolution to the meeting he wished to add only one word to the eloquent phrases in which Sir William Tilden had expressed their thanks, and that was that no more ideal choice could have been made of a lecturer on Julius Thomsen, for surely their lecturer was a man and a chemist—even sometimes "a fighting chemist"—after Thomsen's own heart.

The vote of thanks was carried by acclamation and acknowledged by Sir Edward Thorpe.

Of the following papers, those marked * were read :

*44. "Attempted resolution of racemic aldehydes." By William Ord Wootton.

The author described experiments having for their object the resolution of racemic aldehydes of the type CHRR'·CHO into their optical antipodes by combination with optically active bases, such as *3-aminophenyl-a-camphoramic acid*,

$$CO_2H{\cdot}C_8H_{14}{\cdot}CO{\cdot}NH{\cdot}C_6H_4{\cdot}NH_2.$$

In no case, however, was a resolution effected.

Sodium d-*β*-*phenyl*-*β*-*methylglycidate*,

$$CMePh\begin{cases}CH\cdot CO_2Na\\ O\end{cases},$$

was obtained by resolution of the corresponding *brucine* salt, but this yielded an optically inactive hydratropaldehyde when decomposed by an acid.

A number of new nitro-derivatives of benzylidenecamphor have been prepared, with a view to utilising the corresponding amines in the resolution of racemic aldehydes. The small yields resulting from the condensation of sodium camphor with the three nitrobenzaldehydes, however, have precluded the general application of these substances.

***45. "The influence of colloids and fine suspensions on the solubility of gases in water. Part I. Solubility of carbon dioxide and nitrous oxide." By Alexander Findlay and Henry Jermain Maude Creighton.**

The influence of ferric hydroxide, gelatin, arsenious sulphide, silicic acid, dextrin, starch, glycogen, egg-albumen, and serum-albumen, as well as of suspensions of charcoal and silica, on the solubility of carbon dioxide and nitrous oxide has been studied at pressures varying from about 750 mm. to about 1400 mm. Under atmospheric pressure, silicic acid increases the solubility both of carbon dioxide and of nitrous oxide; ferric hydroxide and gelatin increase the solubility of carbon dioxide, but diminish the solubility of nitrous oxide; arsenious sulphide is practically without influence on the solubility of either gas; charcoal and silica increase the solubility of both gases. The other substances diminish the solubility of both gases.

Various types of solubility-pressure curves have been obtained: 1. Where increased solubility is found, then at higher pressures the solubility curve (*a*) remains nearly horizontal, or falls to a flat minimum (carbon dioxide in presence of silicic acid, ferric hydroxide, gelatin); (*b*) rises continuously (carbon dioxide and nitrous oxide in presence of charcoal and silica, and nitrous oxide in presence of silicic acid). 2. Where decreased solubility occurs, then at higher pressures the solubility curve may either rise continuously or, generally, fall to a minimum and then rise more or less steeply. The cases under 1(*a*) are probably best explained on the basis of chemical interaction; those under 1(*b*) on the basis of "adsorption." The behaviour in the cases under 2 probably depends on the action of two factors, namely, solubility of the gases in a polymerised form in the colloid phase (descending portion of the curve), and "adsorption" (rising portion of the curve).

46. **"The absorption spectra of the vapours of pyridine and some of its derivatives at different temperatures and pressures." By John Edward Purvis.**

The spectra of the vapours of pyridine, α-picoline, 2 : 4-lutidine, 2 : 6-lutidine, 2 : 4 : 6-trimethylpyridine, and piperidine were examined under the conditions of increased temperatures and pressures and at two definite temperatures and decreased pressures. The chief results are :

(1) Pyridine vapour exhibits a considerable number of absorption bands, most of which can be arranged in groups, in having similar appearances and regular differences of wave-lengths. Increased temperatures and pressures cause the bands to widen and new bands to make their appearance, and the general absorption is shifted towards the red end of the spectrum.

(2) α-Picoline shows a considerably less number of bands than the vapour of pyridine, and those which appear are comparable with those of pyridine, and a few bands appear which are not seen in pyridine.

(3) The two lutidines and trimethylpyridine do not exhibit any of the various bands characteristic of pyridine or of α-picoline, but they indicate the presence of a strong absorption band in the ultraviolet region analogous to one found in the other vapours.

(4) Piperidine gives a number of bands which can be divided into groups, and which are unlike those of pyridine.

The results were discussed from the point of view of the vibrations of the atoms of the molecules, when the hydrogen atoms are replaced by methyl groups in the pyridine nucleus, and by the addition of hydrogen atoms in piperidine. They were also compared with the bands observed in alcoholic solutions.

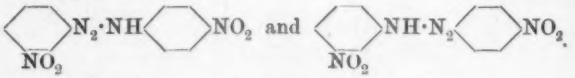
47. **"Absorption spectra and melting-point curves of aromatic diazoamines." By Clarence Smith and Constance Hamilton Watts.**

It has been shown by Meldola and Streatfeild that *m-p'*-dinitrodiazoethylaminobenzene, obtained by the direct ethylation of *m-p'*-dinitrodiazoaminobenzene, is not identical with either *m*-nitrobenzenediazoethylamino-*p*-nitrobenzene, $NO_2 \cdot C_6H_4 \cdot N_2 \cdot NEt \cdot C_6H_4 \cdot NO_2$, or with *p*-nitrobenzenediazoethylamino-*m*-nitrobenzene, but is produced, probably in the form of a compound, by boiling a mixture of equal quantities of the two isomerides in alcohol or benzene.

The absorption spectrum of the directly ethylated compound differs

from that of either of the two isomerides, and is identical with that of the parent mixed diazoamine.

The melting-point curve of the two isomerides has the simple U-shape, with the minimum at the melting point of the directly ethylated compound. The latter, therefore, is a solid solution of equal quantities of the two isomerides, and *m-p'*-dinitrodiazoaminobenzene, which is shown by the spectrometric evidence to have a similar constitution, is a solid solution of equal quantities of the two compounds :

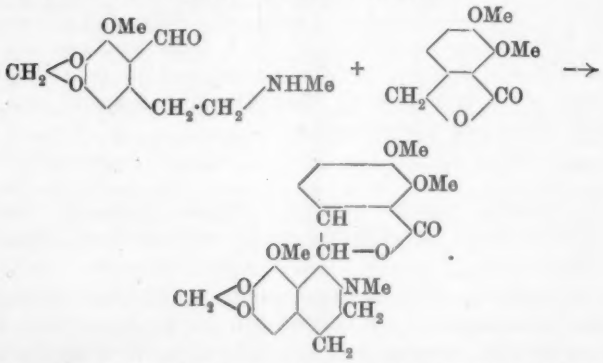


Other sets of triplets are being examined.

48. "Synthesis of *dl*-narcotine (gnoscopine)." Preliminary note. By William Henry Perkin, jun., and Robert Robinson.

During the course of some experiments on the synthesis of the alkaloids, the authors have found that gnoscopine is produced when cotarnine and meconine are boiled in alcoholic solution with potassium carbonate. The synthetical alkaloid melts at 229°, and this melting point was unaltered by admixture with a specimen of gnoscopine from opium, of the some melting point, for which the authors are indebted to Messrs. T. and H. Smith, of Edinburgh.

The synthesis takes place according to the scheme :



The authors intend to apply this reaction to the synthesis of hydrastine, and to complete the synthesis of narcotine, narceine, etc., by resolving gnoscopine into its optically active components and by converting the cotarnic acid which has recently been synthesised (*Trans.*, 1909, **95**, 1977) into cotarnine.

49. "Isomeric chromous chlorides." By William Arthur Knight and Elizabeth Mary Rich.

A rapid and convenient method of preparing pure chromous chloride was described. A dark green modification of the dark blue hydrate, $CrCl_2,4H_2O$, has been found to exist; its solution contains the ions $CrCl^{\cdot}$ and Cl'. Two other new hydrates, $CrCl_2,3H_2O$ (pale blue) and $CrCl_2,2H_2O$ (pale green), have also been prepared.

50. "The chromous chlorides." By William Arthur Knight.

The author has measured several transition points between the solid hydrates of chromous chloride (see preceding paper), and the vapour tensions of several of these systems at various temperatures were determined.

Cryoscopic measurements confirm the results described in the preceding paper, that the blue tetrahydrate is dissociated into three, and the green modification into two, ions.

51. "Silver amalgams." By Chapman Jones.

The author described a method of preparing definite and homogeneous silver amalgams. By the reduction of double or mixed halogen compounds of the metals, amalgams of the compositions: Ag_2Hg, $AgHg$, $AgHg_2$, $AgHg_3$, $AgHg_5$, etc., are obtained. An account of some of the properties of the compounds $AgHg$ and $AgHg_3$ was given.

52. "Derivatives of *S*-phenylphenazothionium. Part III." By Edward de Barry Barnett and Samuel Smiles.

The constitution of the substances obtained by condensation of aromatic derivatives with the diphenylamine *o*-sulphoxides was further discussed, and the analogy between these substances and the simpler phenazothionium salts was shown. The conditions which control the formation of these *S*-phenyl derivatives were dealt with, special reference being made to (*a*) the nature of the sulphoxide, and (*b*) the aromatic compound employed in their formation. Some dyestuffs of this series were also briefly described.

53. "The vapour pressures of two perfectly miscible solids and their solid solutions." By Ernest Vanstone.

In a former paper (*Trans.*, 1909, **95**, 590) it was shown that camphor and borneol form a continuous series of solid solutions. The

vapour pressures of these substances and of a complete series of solid solutions have been measured. The barometric and air-current methods were employed with concordant results. The values obtained for the vapour pressures of camphor are in all cases lower than those of former investigators. The following are the conclusions drawn:

(1) For camphor and borneol, the ratios of the absolute temperatures, corresponding with equal vapour pressures, are constant.

(2) The vapour pressures of solid solutions follow the ordinary mixture law: $P_S = nP_A + (100 - n)P_B/100$, where P_A and P_B are the vapour pressures of the pure subtances A and B, and n = number of molecules of A per 100 of mixture.

(3) The molecular weights of camphor and borneol in the solid solutions are probably normal, also the densities of the vapours at the temperatures employed.

At the next Ordinary Scientific Meeting on **Thursday**, March **3rd**, 1910, at **8.30** p.m., the following papers will be communicated:

"Phenomena observed when potassium mercuric iodide is dissolved in ether and water." By J. E. Marsh.

"The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory." By E. C. C. Baly, W. B. Tuck, and Miss E. G. Marsden.

"Action of ethyl cyanoacetate on 5-chloro-1 : 1-dimethyl-Δ^4 *cyclo*-hexen-3-one." By A. W. Crossley and C. Gilling.

"The constitution of carpaine. Part I." By G. Barger.

"Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate." By A. McKenzie and H. Wren.

"The colour and constitution of azo-compounds. Part V." By J. T. Hewitt and F. B. Thole.

"The direct union of carbon and hydrogen at high temperatures. Part II." By J. N. Pring.

"Affinity relations of cupric oxide and of cupric hydroxide." By A. J. Allmand.

"3-Aminoquinoline and the colour of its salts." By W. H. Mills and W. H. Watson.

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 11/3/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 368.

Thursday, March 3rd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Messrs. A. J. Child, R. H. Cocks, H. H. Hughes, L. C. W. Jenkins, and H. W. Southgate were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Oscar Lisle Brady, B.A., 51, Upper Bedford Place, W.C.
Henry Leslie Farmer Buswell, B.A., 169, Queen's Gate, S.W.
Thomas Patrick Cheetham, Vrijheid, Natal, S.A.
Thomas William Dickson, B.A., 153, Finborough Road, South Kensington, S.W.
Harold Albert Goldsbrough, Churchside, Herne Hill, S.E.
James Kenner, Ph.D., B.Sc., 61, Marlborough Road, Sheffield.
Sea-Kwain Kwoh, 125, Acomb Street, Manchester.
Samuel Lamb, May Villa, Birmingham Road, West Bromwich.
Knowles Preston, Newhaven, Camden Avenue, Feltham, Middlesex.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of Messrs.:

Georges Baume, 44, Quai des Eaux, Vive, Geneva.
Motilal Kashalchand Shah, Byculla Bridge, Byculla, Bombay.

The PRESIDENT read the names of the Fellows recommended by the Council for election as Officers and Ordinary Members of Council of the Society.

It was stated that the Society had become indebted to Mr. Ernest de la Rue for a portrait of the late Dr. Warren de la Rue, who was President of the Chemical Society from 1867 to 1869, and again from 1879 to 1880.

The PRESIDENT announced also that the banquet to the Past-Presidents who have completed fifty years of fellowship would be held at the Savoy Hotel on Thursday, May 26th, 1910.

Of the following papers, those marked * were read :

***54. "Phenomena observed when potassium mercuri-iodide is dissolved in ether and water." By James Ernest Marsh.**

The salt KI,HgI_2,H_2O dissolves in ether with evolution of heat, and this solution dissolves water with a further evolution of heat. On the other hand, water acts on the double salt with absorption of heat and with separation of part of the mercuric iodide; the addition of ether to this mixture brings about complete solution with evolution of heat.

A solution of one molecular proportion of potassium and mercuric iodides in seventeen molecular proportions of ether and water separates, on warming, into three layers. As the temperature rises, the middle layer gradually diminishes in quantity and disappears. On cooling, the middle layer reappears again, and increasing in quantity as the temperature falls, eventually absorbs the other two.

A solution of less concentration than the above gives, on warming, two layers, the upper one increasing as the temperature rises and being re-absorbed as the temperature falls. With a solution of greater concentration, two layers are also formed on warming, but in this case it is the lower layer which increases with the temperature and is re-absorbed on cooling.

When potassium iodide and mercuric iodide in molecular proportions are dissolved in cold ether with the addition of sufficient water to form the double salt KI,HgI_2,H_2O, the latter crystallises on warming the solution, but redissolves on cooling.

In dry ether the two salts dissolve, forming a heavy liquid of the composition $KI,HgI_2,4Et_2O$, which does not appreciably dissolve in excess of ether.

DISCUSSION.

Mr. MARSH, in reply to Mr. Carr, said that the salt $2KI+HgI_2$ did not bring about the miscibility of ether and water to the same extent as the salt $KI+HgI_2$, nor was the effect of change of temperature so marked.

***55. "The relation between absorption spectra and chemical constitution. Part XIV. The aromatic nitro-compounds and the quinonoid theory." By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden.**

It has been proved (*Trans.*, 1908, **93**, 1747) that the nitro-group possesses a free period of vibration, and it follows that if in any compound the nitro-group is in conjunction with a system which also has a free period of vibration, the substance will show an absorption band arising from the isorropesis which takes place. Such compounds are to be found in the substituted nitrobenzenes, where the substituent groups are of the so-called positive type. For example, the nitronaphthalenes, nitrofluorene and nitroquinol dimethyl ether all show well marked absorption bands. The position of the absorption bands depends on the position of the band of the group in conjunction with the nitro-group. The results described throw some doubt on the validity of the quinonoid theory, strong evidence being obtained from the nitrodimethylanilines and the nitrobenzylideneanilines. The position of the absorption band in the nitro-compounds is found to vary with the residual affinity of the solvent. An increase in the residual affinity causes a shift in the band towards the red.

Discussion.

Dr. Hewitt agreed with Mr. Baly in so far as his results pointed to a similarity in constitution for the salts of *p*-nitrophenol and for free *p*-nitroaniline and its dimethyl derivative. He differed, however, in thinking that a quinonoid constitution for *p*-nitrodimethylaniline was not excluded; a substance containing strongly positive and negative groups in the same molecule might well be an internal salt, and a structure such as

was by no means improbable.

Dr. Lowry said that he was able to confirm from his own observations the migration of a band towards the visible region on displacing hydrogen by sodium, and in the opposite direction on displacing hydrogen by acetyl, and also the identity of the spectra of compounds containing the radicles $\cdot NH_2$ and $\cdot ONa$; but he did not believe that the nitro-group was capable of producing an absorption band except when acting in conjunction with other unsaturated groups. Such groups were present in nitrobenzene and in nitrostyrene, but not in nitromethane or in nitroethane; the latter compounds were, how-

ever, very unstable, and the bands (which were not produced by nitrocamphane) might be attributed to decomposition products.

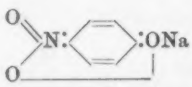
The quinonoid formula for sodium *o*-hydroxycinnamate did not necessarily involve the attachment of sodium to carbon, as the compound might be written: $O{:}C_6H_4{:}CH{\cdot}CH{:}C(ONa)_2$.

Dr. MORGAN said that one interesting point in the paper which had not been referred to by previous speakers was the fact, demonstrated by the authors, that the aromatic meta-nitroamines had absorption spectra quite similar to their ortho- and para-isomerides even when, as in the case of 2-nitrodimethyl-*p*-toluidine, the migration of a labile hydrogen atom could not take place. The colour of these meta-nitroamines was often more intense than that of their ortho- and para-isomerides, and this circumstance negatived the view that the colour of the ortho- and para-series was due to the existence in these compounds of ortho- and para-quinonoid structures respectively. Another weak point in the quinone hypothesis as regards aromatic derivatives was the fact that the heteronuclear nitro-*a*-naphthylamines (1 : 5- and 1 : 8-) were red, whilst the possibly quinonoid ortho- and para-nitro-*a*-naphthylamines were less intensely coloured.

The view that colour was dependent on unsaturation or residual affinity was supported by the study of 6-aminocoumarin. This base and its alkyl and dialkyl derivatives were yellow; but when the nitrogen present passed from the tervalent to the quinquevalent condition, the colour disappeared, and the yellow 6-aminocoumarin yielded colourless salts, quaternary halides, and diazonium derivatives.

Mr. BALY, in reply to Dr. Hewitt, said that it was not possible that the absorption curve obtained with an aqueous solution of *o*-nitrophenol could be a summation curve of those given by *o*-nitrophenol in alcoholic solution and by sodium *o*-nitrophenoxide. In reference to the quinonoid formula suggested for the *o*- and *p*-nitroanilines and their dimethyl compounds, namely (I):

(I.)



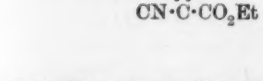
(II.)

since the absorption spectra of the nitroanilines and the corresponding sodium nitrophenoxides were identical, it would be necessary to write similar formulæ for the latter, for example (II), and, as Dr. Hewitt had agreed that this was improbable, it followed that it was equally improbable for the nitroanilines. With regard to Mr. Buttle and Dr. Hewitt's work on picric acid and trinitroanisole, this was dealt with in the paper, where it was shown that their results were capable of a simple explanation.

In reply to Dr. Lowry, he did not understand the objection to the statement that the nitro-group had a free period of absorption, because there seemed to be no doubt whatever on that point as the result of the examination of a great number of compounds.

***56. "Action of ethyl cyanoacetate on 5-chloro-1 : 1-dimethyl-Δ^4-*cyclo*hexen-3-one." By Arthur William Crossley and Charles Gilling.**

It has been shown (*Trans.*, 1909, **95**, 27) that during the action of ethyl malonate on chlorodimethyl*cyclo*hexenone, a solid nitrogenous by-product melting at 141° is obtained, its formation being due to the fact that the ethyl malonate employed contained some ethyl cyanoacetate. When the latter substance is used instead of ethyl malonate in the above condensation, there is produced 75 per cent. of the theoretical quantity of the substance melting at 141°, which has been shown by a detailed study of its properties and transformations to be ethyl hydroxydimethyl*cyclo*hexenylidenecyanoacetate,



57. "The constitution of carpaine. Part I." By George Barger.

Carpaine, the alkaloid from the leaves of the Papaw tree, *Carica Papaya*, L., was discovered by Greshoff, and has been further examined by Merck and by van Ryn (*Arch. Pharm.*, 1897, **235**, 332), who found that it is a secondary base of the formula $C_{14}H_{25}O_2N$.

In the present investigation it has so far been shown that carpaine is hydrolysed by acids and baryta to a substance, $C_{14}H_{27}O_3N$, soluble in water, which contains a carboxyl group and is also a base. It closely resembles certain amino-acids, and the name *carpamic acid* is suggested for it. When heated with alcoholic hydrogen chloride, carpaine yields the hydrochloride of *ethyl carpamate*, $C_{13}H_{26}ON\cdot CO_2Et,HCl$. The hydrochloride of carpaine is transformed by chlorine into a very unstable, neutral *substance*, $C_{14}H_{23}O_3NCl_2$, insoluble in water and melting at 77° after crystallisation from methyl alcohol. The yield of all the above substances is quantitative. On oxidation by potassium permanganate in acetone solution, a nitrogenous acid results, from which ultimately a minute quantity of a crystalline dibasic acid, $C_8H_{14}O_4$, can be obtained, probably $\alpha\delta$-dimethyladipic acid. The latter acid is also produced, in very much larger quantity, by oxidation of carpaine with nitric acid.

58. "Optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate." By Alex. McKenzie and Henry Wren.

The preparation of a number of optically active glycols derived from *l*-benzoin and from methyl *l*-mandelate was described. Whilst *l*-benzoin and certain of its derivatives, such as the methyl ether, undergo racemisation with great ease in the presence of alkali, this racemisation is prevented when the carbonyl group in *l*-benzoin is displaced by the CRR·OH group.

With one exception, the glycols described are dextrorotatory; *l*-triphenylethylene glycol, for example, has $[\alpha]_D + 221{\cdot}3°$ in acetone solution, and, since the same compound may be obtained either from *l*-benzoin or from methyl *l*-mandelate, the change of sign is probably not due to a Walden inversion.

When *l*-triphenylethylene glycol is alkylated by a mixture of methyl iodide and silver oxide, only one of the two hydroxy-groups is methylated. The monomethoxy-compound obtained in this manner has the formula OMe·CHPh·CPh_2·OH, and not

OH·CHPh·CPh_2·OMe,

and has $[\alpha]_D + 185{\cdot}3°$ in acetone solution.

59. "The colour and constitution of azo-compounds. Part V." By John Theodore Hewitt and Ferdinand Bernard Thole.

The authors have isolated benzeneazobenzenediazonium salts (chloride, platinichloride, and chromate or dichromate) in a solid form. Whilst the two former salts were analysed, the salt of chromic acid proved too explosive (compare Meldola and Eynon, *Trans.*, 1905, **87**, 4). The chloride is characterised by great stability, and may be kept for months in a solid state without undergoing appreciable change, whilst its alcoholic solution does not undergo rapid decomposition. From a comparison of the absorption spectrum of this salt with those of aminoazobenzene hydrochloride and benzeneazophenyltrimethylammonium iodide, no deductions are drawn as to its constitution, but attention is drawn to this further case of stability of diazonium salts being greatly increased by negative substituents in the para-position.

Iodoazobenzene in alcoholic hydrogen chloride gives an absorption spectrum which renders it probable that an iodonium salt,

$C_6H_5{\cdot}NH{\cdot}N{:}C_6H_4{:}I{\cdot}Cl$,

is produced. Possibly the compound is formed with two molecules of hydrogen chloride.

60. "The direct union of carbon and hydrogen at high temperatures. Part II." By John Norman Pring.

In continuation of an earlier investigation (Pring and Hutton, *Trans.*, 1906, **89**, 1591), the author has made a quantitative study of the reaction between carbon and hydrogen at temperatures ranging from 1100° to 2200°. The materials used were submitted to the most exhaustive purification, and the presence of moisture and nitrogen was carefully eliminated. The carbon was heated electrically, and out of all contact with any possible source of contamination. Direct union with hydrogen was found to occur at all temperatures, methane being formed below 1800°, and methane, acetylene, and ethylene above this temperature. The formation of methane reached a minimum (0·16 per cent.) at about 1550°.

Some experiments carried out on the decomposition of acetylene and methane showed that at 1775° the former gas changes quickly into the latter, and the methane decomposes only very slowly. At 1200°, small percentages of acetylene in an excess of hydrogen were found to change slowly into methane and ethylene. In presence of platinum, the reaction between the carbon and the hydrogen was very much accelerated, and values were obtained which, at 1200°, amounted to 0·55 per cent., and at 1500° to 0·30 per cent., of methane. On decomposing an excess of methane, an amount equal to 0·59 per cent. of the gas at 1200°, and 0·33 per cent. at 1500°, remained; consequently, these numbers probably represent equilibrium values, in presence of platinum, at the temperatures mentioned.

61. "Affinity relations of cupric oxide and of cupric hydroxide" By Arthur John Allmand.

Crystalline cupric hydroxide is stable in ordinary moist air. When, however, it is shaken with alkaline or ammoniacal solutions at 25°, it loses water and becomes converted into cupric oxide. These two facts are apparently contradictory, and to explain them, tensimetric and electrometric experiments have been carried out, leading to the following results.

(*a*) Freshly-prepared cupric oxide *ages* with time, and its free energy content thereby falls.

(*b*) This ageing is attributed to increasing molecular complexity—not to crystallisation or to surface changes—and is irreversible.

(*c*) The explanation given accounts qualitatively for the electromotive behaviour of samples of copper oxide which have been subjected to varying thermal treatment, and may perhaps throw some

light on phenomena noticed in the determination of dissociation pressures of certain oxides at higher temperatures.

(*d*) The tensimetric and electrometric evidence shows that crystalline cupric hydroxide is stable with respect to freshly-prepared cupric oxide and unstable with respect to aged samples of cupric oxide. A saturated solution of cupric hydroxide is unsaturated with respect to "fresh" cupric oxide, and supersaturated with respect to "aged" cupric oxide, which fact explains the apparently anomalous stability relations of cupric hydroxide, on the one hand, and cupric oxide and water on the other.

(*e*) The free energy changes associated with a number of reactions at the ordinary temperature have been measured or calculated.

(*f*) The dissociation pressure of cupric oxide at 1030° has been deduced, and shows excellent agreement with the experimentally determined values.

62. "3-Aminoquinoline and the colour of its salts." By William Hobson Mills and Walter Henry Watson.

Quinoline-3-carboxylic acid has been prepared by a new method, and converted into *3-aminoquinoline*, which exists in two forms, melting at 84° and 94° respectively. The salts of the base with one equivalent of acid are intensely yellow and fluorescent. The gradual addition of acid to the solution of a fixed amount of base is accompanied by remarkable variations of colour intensity, which are explained as being chiefly due to the formation of a semi-hydrochloride. In addition to a number of salts of the base, the following compounds have been prepared: *quinoline-3-carboxylamide*, *3-acetylaminoquinoline*, *3-quinolineazo-β-naphthol*, *3-hydroxyquinoline*, *2-chloroquinoline-3-carboxylamide*, *2-chloro-3-aminoquinoline*.

63. "The absorption spectra of *p*-toluidine, *m*-xylidine, and of their condensation products with acetaldehyde." By John Edward Purvis.

From an examination of the absorption spectra of the substances mentioned in the title, the author finds that (1) the absorption curves of *p*-toluidine and *m*-xylidine are very similar; (2) the condensation products with acetaldehyde show a disappearance of the more refrangible band of the original bases; (3) the isomeric α- and β-condensation products show very slight differences in the persistencies of the bands; and (4) the addition of hydrochloric acid to the condensation products has no effect on the form or the persistency of the band.

64. "**A supposed case of stereoisomeric tervalent nitrogen compounds.**" **By Humphrey Owen Jones and Edward John White.**

Miller and Plöchl (*Ber.*, 1896, **29**, 1462) found that the interaction of *m*-xylidine and acetaldehyde in acid solution gave rise to two compounds of the formula $C_{12}H_{17}ON$: these were supposed to be stereoisomeric compounds containing tervalent nitrogen. This conclusion is at variance with the views now held concerning nitrogen compounds, and these substances have therefore been re-examined.

The method of preparation has been improved, and it is found that the more soluble α-compound melts at 103—104°, while the less soluble β-compound melts at 127—128°.

The α-compound is *not* transformed into the β-compound by the action of heat or of solvents, but in acid solution each is transformed into an equilibrium mixture, containing two molecular proportions of the α- and one molecular proportion of the β-compound, and this mixture is gradually transformed into 2 : 6 : 8-trimethylquinoline.

Both compounds give the same oxime, benzoyl derivative, phenylbenzylhydrazone, methyl derivative, and condensation product with *m*-xylidine, but give different products with hydrogen chloride and with nitrous acid.

It is clear that the compounds are not stereoisomerides, and it is suggested that the α-compound has the constitution

$$C_6H_3Me_2\cdot NH\cdot CHMe\cdot CH_2\cdot CHO,$$

whilst the β-compound has the constitution

$$C_6H_3Me_2\cdot N\begin{<}\begin{matrix}CHMe\\CH(OH)\end{matrix}\end{>}CH_2,$$

in which the ring readily undergoes fission.

Similar isomeric compounds have been obtained from *p*-toluidine and from ψ-cumidine.

65. "**The isolation of stable salt hydrates, with special reference to the stable hydrates of sodium carbonate.**" **By Alexander Charles Cumming.**

If a mixture of hydrates is exposed to the dehydrating action of a large supply of the corresponding anhydrous salt, the hydrates lose water until the lowest hydrate is left in a pure state, after which no further dehydration occurs. The next lowest hydrate may be prepared in a similar manner by the use of the lowest hydrate as the desiccating agent. It is very probable that all the hydrates of a salt may be prepared in this manner. The process may be carried out in the reverse direction, that is, a hydrate may be prepared in a pure state by

the hydrating action of the next higher hydrate, or in the case of the highest hydrate by the hydrating action of the saturated solution.

These two methods have been applied to the isolation of the monohydrate, heptahydrate, and decahydrate of sodium carbonate. The rates at which these and other hydrates gain or lose water under certain conditions, and some incidental phenomena, such as a well-defined case of suspended transformation, were described.

66. "Salts and ethers of 2 : 3 : 5-trinitro-4-acetylaminophenol." By Raphael Meldola and Harold Kuntzen.

The trinitroacetylaminophenol described in 1906 (*Trans.*, **89**, 1935), which is a pale yellow substance, gives a series of highly coloured and beautifully crystalline salts with metals and certain organic bases. An account of the preparation and properties of these salts was given. The absorption spectrum of the free compound and of its sodium salt, for a study of which the authors are indebted to Dr. J. T. Hewitt, indicates a difference of constitution, and the "*iso*nitro" form is suggested for the salts in explanation of this difference. It was thought possible, in view of the special character of the groups attached to the iminic nitrogen atom in this substance,

$$C_2H_3O\cdot NH\cdot C_6H(NO_2)_3\cdot OH,$$

in which two acid radicles are associated with one hydrogen atom, that conditions might be favourable for the production of an asymmetric molecule containing a tervalent nitrogen atom. An attempt to resolve the compound by means of its brucine salt led, however, to a negative result, but the experiments in this direction are being continued. The silver salt on methylation gives a *methyl ether* (m. p. 194°), which on hydrolysis by sulphuric acid yields 2 : 3 : 5-*trinitro*-4-*aminoanisole*. The new trinitroanisidine crystallises in dull red, glistening scales melting at 138—139°.

67. "The interaction of hydrogen and chlorine. The inhibitive effect of ozone and chlorine dioxide." (Preliminary note.) By David Leonard Chapman and Patrick Sarsfield MacMahon.

In their last communication on this subject (*Trans.*, 1909, **95**, 1717), the authors expressed the opinion that those substances which prevent or retard the photochemical interaction of hydrogen and chlorine take part in a chemical change with one or more of the constituents of the system hydrogen–chlorine–hydrogen chloride, and that the efficient energy of the chlorine derived from the light is dissipated in causing the change in which the inhibitor participates,

thus being rendered incapable of bringing about the union of the hydrogen and chlorine. In complete harmony with this view is the recent discovery that very small quantities of ozone or chlorine dioxide—substances which can obviously react with hydrogen chloride—prevent for a considerable time the interaction of hydrogen and chlorine in light. These effects are being examined in detail, and the influence of other oxidising gases on the interaction of chlorine and hydrogen is being investigated.

68. "Diketodiphenylpyrroline and its analogues. Part III." By Siegfried Ruhemann.

The colourless compound $C_{23}H_{18}O_3N_2$, which is formed together with diketodiphenylpyrroline by the action of sodiobenzamide on ethyl phenylpropiolate, was found not to have the formula

$$NHBz\cdot CPh{:}CH\cdot CO\cdot NHBz$$

(*Trans.*, 1909, **95**, 984), but $NHBz\cdot C(OH)\begin{matrix}CPh{:}C\,Ph\\ CO{-}NH\end{matrix}$, for, on boiling with potassium hydroxide, it yields deoxybenzoin besides ammonia, oxalic acid, and benzoic acid, and with cold concentrated sulphuric acid decomposes into diketodiphenylpyrroline and benzamide. The substance $C_{23}H_{18}O_3N_2$, therefore, is an additive compound of the diketopyrroline with benzamide. Further, the diketopyrroline unites with phenylmercaptan or piperidine to form the compounds

$$C_{16}H_{11}O_2N,C_6H_6S$$

and $C_{16}H_{11}O_2N,C_5H_{11}N$ respectively; it also condenses with phenol in a manner similar to isatin, and yields the compound

$$(C_6H_4\cdot OH)_2C\begin{matrix}CPh{:}C\,Ph\\ CO{-}NH\end{matrix}.$$

The diketopyrrolines give the indophenine reaction.

69. "Triphenyl-2-pyrone." By Siegfried Ruhemann.

Whereas acetone or acetophenone reacts with ethyl phenylpropiolate and sodium ethoxide to yield 4-pyrone derivatives (*Trans.*, 1908, **93**, 431, 1281), such a condensation does not take place on using *p*-tolyl methyl ketone, propiophenone, or methyl ethyl ketone; the only change which occurs is the hydrolysis of the acetylenic ester. Deoxybenzoin, however, condenses with ethyl phenylpropiolate with the formation of *4 : 5 : 6-triphenyl-2-pyrone*, $O\begin{matrix}CO{-}CH\\ CPh{:}CPh\end{matrix}\!\!>CPh$ (m. p. 245—246°). This compound is decomposed by potassium hydroxide in two directions, namely:

$$(1)\quad C_{23}H_{16}O_2 + H_2O = CO_2 + C_{22}H_{18}O,$$

and yields an alkylidenedeoxybenzoin. On account of its behaviour on melting (it softens at 76° and is completely melted at 90°), it is regarded as a mixture of stereoisomerides of methylbenzylidenedeoxybenzoin, CPhMe:CPh·COPh, which could not be separated by crystallisation. Another part of the 2-pyrone compound decomposes thus:

$$(2)\ C_{23}H_{16}O_2 + 2KHO = CH_2Ph{\cdot}CPh{:}CH{\cdot}CO_2K + C_6H_5{\cdot}CO_2K$$

to form a mixture of isomeric β-benzylcinnamic acids, one of which could be obtained pure and melts at 168—169°. This acid, on reduction, yields β-phenyl-β-benzylpropionic acid (m. p. 95—96°), and with concentrated sulphuric acid condenses to 3-phenyl-1-naphthol,

$$C_6H_4\begin{cases} C(OH){:}CH \\ CH{=}CPh \end{cases}$$

(m. p. 100—101°).

70. "The solubility of organic acids and bases in solutions of their salts." (Preliminary note.) By Nevil Vincent Sidgwick.

Aniline is known to be more soluble in a solution of its hydrochloride than in pure water. An attempt was made to determine how far this property was shared by other bases, and by phenols and acids. *o*-Toluidine behaves in the same way as aniline; but the alkylamines examined (amylamine, diamylamine, and dipropylamine) appeared to be less soluble in the salt solution.

With phenols and monobasic acids an increase of solubility was found in every instance, whether they separated from the solution as liquids or as solids. The results are contained in the following table.

Substance.	Temperature.	Normality of salt.	Solubility in Water.	Solubility in Salt Solution.	Ratio.	*K*.
Aniline	25°	1	0·38	0·54	1·4*	$0·05 \times 10^{-3}$
	40°	1	0·42	0·65	1·5*	
	60°	1	0·50	0·81	1·6*	
	80°	1	0·61	1·07	1·7*	
o-Toluidine	25°	1	0·14	0·28	2·0	
Phenol	25°	1	0·85	—	—	50×10^{-3}
o-Cresol	25°	1	0·24	0·70	2·9*	
	40°	1	0·26	0·77	3·0*	
	60°	1	0·31	0·91	3·0*	
	80°	1	0·39	1·26	3·2*	
o-Nitrophenol	48°	1	0·028	0·069	2·4*	750×10^{-3}
Benzoic acid	25°	1	0·026	0·044	1·7	0·006
p-Toluic acid	25°	1	0·0031	0·0054	1·8	0·005
p-Nitrobenzoic acid	25°	1	0·0024	0·0046	1·9	0·040
Salicylic ,,	25°	1	0·016	0·036	2·3	0·102
Cinnamic ,,	25°	0·5	0·0041	0·0105	2·5	0·004
β-Phenylpropionic acid.	25°	1	0·050	1·15	22·9*	0·023
	11°	<1	0·032	0·051	1·6	
Hippuric ,,	25°	1	0·039	0·078	2·0	0·022
β-Iodopropionic ,,	25°	1	0·40	0·63	1·6	0·009

Those cases where the substance separates in the liquid form are marked with an asterisk.

The table gives the solubility (in terms of normality) of the substance in the salt solution and in pure water, the ratio of the first of these to the second, and the dissociation constant of the acid or base.

β-Phenylpropionic acid at 25° separates in a liquid form containing less than 50 per cent. of pure acid; at 11° the solid acid crystallises out, but some of the salt with it. Phenol is miscible in all proportions with a normal solution of its sodium salt at temperatures above 13°.

Where the substance separates as a liquid, the salt no doubt dissolves in both layers, and this may partly (and perhaps wholly in the case of the aromatic amines) explain the increase in solubility, since the mutual solubility of two liquids is always increased by the addition of a third substance, which dissolves more or less equally in both. Where the solid acid separates, this explanation cannot apply, and the phenomenon is probably due to the formation in the solution of a compound between the acid and the salt or its ions. This is confirmed by the numerous instances in which acid salts of monobasic acids, of the type $NaHA_2$, have been isolated in the solid state (see Farmer, *Trans.*, 1903, **83**, 1440).

The work is being continued.

71. "1:4-Dichloroanthraquinone and its derivatives." By Gertrude Maud Walsh and Charles Weizmann.

An account was given of the condensation of 3:6-dichlorophthalic anhydride with benzene and with the methyl ethers of *o*-, *m*-, and *p*-cresol.

72. "The synthesis of Δ^1-*cyclo*penteneacetic acid and of 1-methyl-Δ^2-*cyclo*hexene-3-acetic acid." By Victor John Harding and Walter Norman Haworth.

The condensation of *cyclo*pentanone and 1-methyl*cyclo*hexan-3-one with ethyl cyanoacetate, either through the agency of sodium ethoxide or piperidine, gives rise to cyano-esters containing the ethylene linking in the ring. These cyano-esters,

$$\begin{matrix}CH_2{-}CH\\ |\\ CH_2{\cdot}CH_2\end{matrix}\!\!>\!C{\cdot}CH(CN){\cdot}CO_2Et \text{ and } CH_2\!<\!\begin{matrix}CH_2{-}CH_2\\ |\\ CHMe{\cdot}CH\end{matrix}\!\!>\!C{\cdot}CH(CN){\cdot}CO_2Et,$$

on hydrolysis yield the corresponding acetic acids:

$$\begin{matrix}CH_2{-}CH\\ |\\ CH_2{\cdot}CH_2\end{matrix}\!\!>\!C{\cdot}CH_2{\cdot}CO_2H \text{ and } CH_2\!<\!\begin{matrix}CH_2{-}CH_2\\ |\\ CHMe{\cdot}CH\end{matrix}\!\!>\!C{\cdot}CH_2{\cdot}CO_2H.$$

73. "Solubilities below and above the critical temperature." By Dan Tyrer.

The solubilities of sodium iodide in ethyl alcohol and of potassium iodide in methyl alcohol have been measured from the ordinary temperature to about 300°. In both cases the solubility in the liquid solvent at first increases and then decreases. Just below the critical temperatures of the saturated solutions the solubility decreases very rapidly, the curve being almost parallel to the solubility axis. It is found that above the critical point the salts dissolve to quite moderate extents. The solubility above the critical point, however, depends on the concentration of the solvent, that is, the amount of solvent contained in unit-volume. The effect of temperature on the solubility in a solvent of a particular concentration is very slight, but is greatest for the greatest concentrations, and for small concentrations it becomes immeasurably small.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

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Hellsten, *A. F.* Der Einfluss des Trainierens auf die CO_2–Abgabe bei isometrischer Muskelarbeit. (From the *Skand. Archiv. Physiol.,* 1909, **22.**)

Kerp, *W.,* and **Wöhler,** *P.* Zur Kenntnis der gebundenen schwefligen Säuren. IV und V Abhandlung. (From the *Arb. Kais. Gesundheitsamte,* 1909, **32.**)

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Kremann, *R.,* and **Hüttinger,** *K.* Über die Löslichkeit von Aluminiumhydroxyd in Aluminiumsulfatlösungen und zur künstlichen Darstellung von Alumian. (From the *Jahrb. K. K. Geol. Reichsanstalt,* 1908, **58**).

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ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Friday, March 18th, 1910, at 5 p.m., when the President will deliver his address, entitled, "The Union of Hydrogen and Oxygen in Flame."

At the next Ordinary Scientific Meeting on **Thursday**, March **17**th, 1910, at **8.30** p.m., the following papers will be communicated:

"Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group." By F. Challenger and F. S. Kipping.

"Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphocarboxylic acid and its derivatives." By T. M. Lowry, C. H. Desch, and F. W. Southgate.

"Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor." By T. M. Lowry and H. W. Southgate.

"The action of aromatic amines on malonic ester." By F. D. Chattaway and J. M. D. Olmsted.

R. CLAY AND SONS, LTD., BREAD STREET HILL, E.C., AND BUNGAY, SUFFOLK.

[*Issued* 30/3/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 369.

Thursday, March 17th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society in the death of Geheimrath Professor Dr. Hans Landolt (elected an Honorary and Foreign Member in 1888), and, on the same day, Monday, March 14th, of Professor James Campbell Brown, a Vice-President of the Society.

Messrs. A. L. Landau and N. V. Sidgwick were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Bethwaite, 48, Northumberland Street, Workington.

Harry Farrands, M.A., The College, Isleworth.

Charles Samuel Garland, 18, Derwent Grove, Dulwich, S.E.

Edwin Harrison, 18, Old Swan Lane, Upper Thames Street, E.C.

Horace George Mason, B.Sc., The Grammar School, Kingsbridge, South Devon.

Francis Edwin Needs, 7, Effingham Road, St. Andrew's Park, Bristol.

Of the following papers, those marked * were read:

*74. "**Organic derivatives of silicon. Part XIII. Optically active compounds containing one asymmetric silicon group.**" By **Frederick Challenger and Frederic Stanley Kipping.**

Experiments on the resolution of *dl*-dibenzylethylpropylsilicane-monosulphonic acid, $CH_2Ph{\cdot}SiEtPr{\cdot}CH_2{\cdot}C_6H_4{\cdot}SO_3H$ (Part XII, *Trans*

1910, **97**, 142), were described. Several bases were tried without success, but on systematically crystallising the brucine salt, extreme fractions differing in melting point by about 80° were obtained. These two fractions had the same specific rotations. The sparingly soluble one contained an acid which with *l*-menthylamine, cinchonidine, and strychnine gave compounds identical in melting point and specific rotation, within the limits of experimental error, with the corresponding salts of the *dl*-acid. Moderately concentrated solutions of the sodium salt of this resolution product seemed to be optically inactive.

In these circumstances additional evidence had to be procured before arriving at a definite conclusion, but in the end it was proved beyond all question that the acid had been resolved into its enantiomorphously related components.

The optically pure *l*-acid, prepared from the sparingly soluble brucine salt, has a specific rotation of about $[\alpha]_D$ − 0·75° in concentrated alcoholic solutions of its sodium salt. With all optically active bases which were examined, except, of course, with brucine, it gives salts which are almost indistinguishable by melting point or specific rotation determinations from the corresponding derivatives of the *dl*-acid.

These results are very similar to those previously obtained in the case of the active and *dl*-sulphobenzylethylpropylsilicyl oxides, which contain two asymmetric silicon groups (Kipping, *Trans.*, 1907, **91**, 234; 1908, **93**, 465), but in the present instance the enantiomorphous character of the active acid is even more rarely exhibited.

*75. "The rate of hydration of acetic anhydride."

By Albert Cherbury David Rivett and Nevil Vincent Sidgwick.

The authors have determined the velocity of the above reaction in water at 25° by means of the conductivity. The conductivity and viscosity of solutions of acetic acid from 3*N* downwards were measured, and it was shown that if the ionic velocity is assumed to be proportional to the fluidity (the reciprocal of the viscosity), Ostwald's law holds for this acid up to a normality of 0·94, whereas in its simple form it does so only up to 0·05.

The velocity of hydration of the anhydride showed that the reaction was a unimolecular one. It is not catalysed by hydrogen ions, and beyond a certain point the constant falls steadily with increasing concentration.

***76. "The colour and ionisation of cupric salts. Part II." By Nevil Vincent Sidgwick and Henry Thomas Tizard.**

In continuation of previous work (*Trans.*, 1908, 93, 187), the authors have redetermined the depth of colour of cupric acetate, propionate, and formate in water, and the influence of acid on it. Excess of acid markedly diminishes the colour in the acetate and propionate, the diminution reaching a limit when about one equivalent of acid has been added; further addition has no effect. No change is produced with the formate. This points to the existence of hydrolysis, the product of which has in the first two cases a deeper colour than the salt. The fall in (molecular) colour on adding excess of acid is constant, and independent of the dilution.

The conductivity and viscosity of solutions of these three salts, (1) neutral, (2) in presence of one equivalent, (3) in presence of two equivalents of the acid, have also been measured. In strong solutions of the acetate or propionate, the second equivalent diminishes the conductivity, owing no doubt to the increase of viscosity. Assuming ionic velocity to be proportional to fluidity, then if μ_0, μ_1, μ_2 are the molecular conductivities, and η_0, η_1, η_2 the viscosities of the three solutions at any concentration, $M = \mu_1\eta_1 - (\mu_2\eta_2 - \mu_1\eta_1)$ is the corrected conductivity of a neutral solution in which no hydrolysis should occur. The difference $H = M - \mu_0\eta_0$ is the change of conductivity due to the hydrolysis. H was found to be very nearly constant. It increases slightly with dilution, but much less than M, which appears to indicate the improbable conclusion that the hydrolysis diminishes with increasing dilution.

If the only dissociation taking place over the range examined is $CuA_2 \rightleftharpoons CuA^{\cdot} + A'$, and the colour of CuA_2 and $CuA^{\cdot}$ is constant, and if M is proportional to the degree of ionisation, then on plotting the colour against M, a straight line should be obtained. As a fact, however, the rise of colour at high concentrations is greater than this. Possible causes of this disagreement were discussed.

From the values of M, those of the velocities of the $CuA^{\cdot}$ ion and of K, the dissociation constant of the salt, have been calculated. The agreement in K at not too great dilutions is good, but the ionic velocities are unexpectedly high.

***77. "Some new metallic carbonyls." By the late Ludwig Mond, Heinrich Hirtz, and Matthewman Dalton Cowap.**

A description was given of a new *cobalt carbonyl*, $Co(CO)_3$, which is obtained by the action of heat on the carbonyl $Co(CO)_4$. *Molybdenum carbonyl*, $Mo(CO)_6$, and a *ruthenium carbonyl* have also been prepared.

***78. "Studies of dynamic isomerism. Part X. The relationship between absorption spectra and isomeric change. Absorption spectra of camphorcarboxylic acid and its derivatives." By Thomas Martin Lowry, Cecil Henry Desch, and Herbert William Southgate.**

Four types of absorption curve were described:

(1) Camphorcarboxylic acid, its sodium salt, esters, amide, and piperidide give a shallow band at $1/\lambda$ 3450. This band is also given by the dimethyl derivative, $C_8H_{14}<\begin{matrix}CMe\cdot CO_2Me\\ |\\ CO\end{matrix}$, and is attributed to the carbonyl group. The diethyl derivative is abnormal, and appears to be differently constituted.

(2) The halogen derivatives, $C_8H_{14}<\begin{matrix}CCl[Br]\cdot COX\\ |\\ CO\end{matrix}$, give continuous absorption curves, but with a well-marked extension near the point where the bands appear in the spectra of the parent substances.

(3) In presence of alkalis the esters and amide give a deep band at $1/\lambda$ 3450; this is attributed to the formation of an enolic sodium salt, $C_8H_{14}<\begin{matrix}C\cdot COX\\ ||\\ C\cdot ONa\end{matrix}$.

(4) The enolic acyl derivatives, $C_8H_{14}<\begin{matrix}C\cdot CO\cdot O\cdot R_1\\ ||\\ C\cdot O\cdot CO\cdot R_2\end{matrix}$, give continuous absorption curves.

***79. "Studies of dynamic isomerism. Part XI. The relationship between absorption spectra and isomeric change. Absorption spectra of the acyl derivatives of camphor." By Thomas Martin Lowry and Herbert William Southgate.**

(1) Oxymethylenecamphor and its methyl and ethyl esters, $C_8H_{14}<\begin{matrix}C:CH\cdot OR\\ |\\ CO\end{matrix}$, give a deep band at $1/\lambda$ 3800.

(2) The bromo-derivative, $C_8H_{14}<\begin{matrix}CBr\cdot CHO\\ |\\ CO\end{matrix}$, gives a continuous curve with a well-marked extension.

(3) The sodium salt, $C_8H_{14}<\begin{matrix}C\cdot CHO\\ ||\\ C\cdot ONa\end{matrix}$, gives a deep band at $1/\lambda$ 3350. The same band is given by aminomethylenecamphor, which is therefore formulated as $C_8H_{14}<\begin{matrix}C\cdot CHO\\ ||\\ C\cdot NH_2\end{matrix}$. The anhydride gives a band at $1/\lambda$ 3500, and is probably $C_8H_{14}<\begin{matrix}C\cdot CO\cdot H\\ ||\\ C\end{matrix}\!\!-\!\!O\!\!-\!\!\begin{matrix}H\cdot CO\cdot C\\ ||\\ C\end{matrix}>C_8H_{14}$, whilst the

acetyl derivative, which gives a band at $1/\lambda$ 4000, is perhaps $C_8H_{14}<\begin{matrix}C{:}CH\cdot OAc\\ CO\end{matrix}$.

(4) Acetyl-, propionyl-, and butyryl-camphor give a band at $1/\lambda$ 3550; on the addition of sodium hydroxide, a deep band is developed at $1/\lambda$ 3250.

(5) Benzoylcamphor (enolic form) gives a band at $1/\lambda$ 3250; this is moved to $1/\lambda$ 3150 in the sodium salt, and to $1/\lambda$ 3500 in the acetyl and benzoyl derivatives.

80. "**The action of aromatic amines on ethyl malonate.**" By **Frederick Daniel Chattaway and James Montrose Duncan Olmsted.**

The statements hitherto made respecting this reaction leave the impression that the esters of malonanilic and malonotoluidic acids are only to be obtained with difficulty, and that they are not formed by the interaction of malonic ester and aromatic amines.

The recent work of Chattaway and Mason (*Trans.*, 1910, **97**, 339) has shown that the interaction of malonic ester and halogen-substituted anilines follows a perfectly regular course, and that both halogen-substituted ethyl malonanilates and malonanilides are formed.

The authors find that unsubstituted aromatic amines act similarly. When aniline or a toluidine is heated with ethyl malonate, the ester of malonanilic or the corresponding malonotoluidic acid is first formed, this being converted into malonanilide or a malonotoluidide by the further action of the amine. As the corresponding acids can be obtained in nearly theoretical amounts by hydrolysing the esters, this is by far the simplest method of preparing them.

81. "**Synthesis of dipeptides of lauric and *n*-nonoic acids. Products of the condensation of lauric and *n*-nonoic acids with glycine, alanine, and leucine.**" (**Preliminary note.**) By **Arthur Hopwood and Charles Weizmann.**

During the course of some experiments on the synthesis of substances of possible physiological importance, the authors have prepared the following:

α-Bromo-n-*nonoyl chloride*, $C_8H_{16}Br\cdot COCl$, prepared by heating α-bromononoic acid and phosphorus pentachloride, boils at 118—120°/9 mm.

α-Bromo-n-*nonoylglycine*, $C_8H_{16}Br\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$, prepared by the interaction of α-bromononoyl chloride and glycine in alkaline solution, is crystalline and melts at 116°.

α-Amino-n-*nonoylglycine*, $NH_2 \cdot C_8H_{16} \cdot CO \cdot NH \cdot CH_2 \cdot CO_2H$, prepared from α-bromononoylglycine and concentrated aqueous ammonia, melts at 215—216°.

A similar series of compounds has been obtained by the condensation of α-bromo-*n*-nonoyl chloride with alanine and with leucine; also from *n*-lauric acid by the interaction of α-bromo-*n*-lauryl chloride and glycine, alanine, and leucine respectively.

82. "The densities and molecular weights of neon and helium." By Herbert Edmeston Watson.

A considerable quantity of neon has been prepared in a high state of purity, the separation from helium having been effected by a fractionation from charcoal at the temperature of liquid air.

The weight of a normal litre of this gas was found to be 0·9002 gram, this being the mean of eleven determinations, and the error should not exceed 0·0003. The value originally found by Ramsay and Travers was 0·891.

The density of helium was also measured, the figure 0·1782 being obtained, but as this was the mean of only two determinations with the same sample of gas, it should not be considered correct to more than 1 part in 500.

Some experiments were carried out on the rate of diffusion of a mixture of neon and helium through quartz, with the view of effecting a separation by this means. It was found, however, that quartz is slightly permeable to neon, and, moreover, that the rate of diffusion of helium was far smaller than had been expected.

An estimate of the amounts of helium and neon in the atmosphere gave the values 1 part by volume in 185,000 and 1 in 55,000 respectively.

In conjunction with Mr. F. P. Burt, the author has calculated, according to Berthelot's method, the molecular weights of these gases, using the figures obtained by Burt for the compressibility of helium and neon at 0° (*Trans. Faraday Soc.*, 1910, **6**, Pt. I.) and the above values for the densities. The molecular weight of helium is thus found to be 3·994, and of neon, 20·200.

83. "The molecular weights of krypton and xenon." By Herbert Edmeston Watson.

The densities of krypton and xenon were recently determined by Moore (*Trans.*, 1908, **93**, 2181), but in deducing the molecular weights, no correction was applied for compressibility, although with these gases this correction may amount to a considerable quantity.

The compressibility has now been calculated from the critical constants by Guye's method (*J. Chim. Phys.*, 1905, 5, 5), and the figures obtained were compared with those deduced from the compressibility measurements of Ramsay and Travers (*Proc. Roy. Soc.*, 1901, **67**, 329). As these were carried out only at pressures exceeding 25 atmospheres, there is naturally a considerable amount of uncertainty in the results, but, nevertheless, the agreement is as good as can be expected.

The results obtained, as well as the corresponding figures for the other inactive gases, are summarised in the following table, L being the weight of a normal litre, and A the compressibility coefficient between 0 and 1 atmosphere:

	L (grams).	$A \times 10^5$.	Mol. wt.
Helium	0·1782	0	3·994
Neon	0·9002	105	20·200
Argon	1·7809	−93	39·881
Krypton	3·708	−215	82·92
Xenon.....	5·851	−690	130·22

84. "**Studies in the diphenyl series. Part I. Acetylation of benzidine derivatives.**" **By John Cannell Cain and Percy May.**

The authors have studied the acetylation, by means of acetic anhydride in aqueous-alcoholic solution, of several bases of the benzidine series, and have determined the relative proportions of mono- and di-acetyl derivatives formed.

The presence of negative groups in all cases diminishes the degree of acetylation, and it was suggested that this influence of negative groups (which of course is well known) may be due to the existence of a double linking between the negative atom or group and the nitrogen atom.

Several new mono- and di-acetyl derivatives of substituted benzidines were described.

85. "**Additive compounds of *s*-trinitrobenzene with arylamines. Combination as affected by the constitution of the arylamine.**" **By John Joseph Sudborough and Stanley Hoskings Beard.**

A description was given of additive compounds prepared from *s*-trinitrobenzene and a number of aromatic amines, and the relationship between the constitution of the amine and (*a*) its capacity to form an additive compound, (*b*) the colour of the additive compound, was discussed.

BANQUET TO PAST PRESIDENTS.

The Banquet to Past Presidents will be held at the Savoy Hotel, on Thursday, May 26th, 1910.

Further particulars will be announced shortly.

At the next Ordinary Scientific Meeting on Thursday, April 21st, 1910, at 8.30 p.m., the following papers will be communicated:

"Tetranitroaniline." By B. Flürscheim and T. Simon.

"Experiments on the Walden inversion. Part IV. The interconversion of the optically active atrolactinic acids." By A. McKenzie and G. W. Clough.

"Studies in fermentation. Part III. The rôle of diffusion in fermentation by yeast cells." By A. Slator and H. J. S. Sand.

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PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 370.

Friday, March 18th, 1910, at 5 p.m., Annual General Meeting, Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

Mr. J. S. S. BRAME and Dr. N. V. SIDGWICK were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The Report of the Council on the progress of the Society during the past twelve months was presented by the PRESIDENT, and the Treasurer, after making a statement as to the Society's income and expenditure for 1909, proposed a vote of thanks to the Auditors, which was seconded by Mr. A. C. CHAPMAN and acknowledged by Dr. J. A. VOELCKER.

The adoption of the Report of Council together with the Balance Sheet and Statements of Accounts for the year ended December 31st, 1909, proposed by Dr. G. MCGOWAN and seconded by Dr. H. BRERETON BAKER, was put to the Meeting and carried unanimously.

REPORT OF THE COUNCIL.

The Council is again in a position to report favourably on the progress of the Society, as indicated by an increase in the number of Fellows and in the list of papers communicated.

On the 31st December, 1908, the number of Fellows was 2,950. During 1909, 160 Fellows have been elected and 7 were reinstated, the gross total thus being 3,117. The Society has lost 25 Fellows by death; 43 have resigned; the election of 2 Fellows has become void, and 44 Fellows have had their names removed from the List for non-payment of Annual Subscriptions.

The total number of Fellows, therefore, at the 31st December, 1909, was 3,003, showing a net increase of 53 over the preceding year.

The names of the deceased Fellows, with the dates of their election, are:

R. Bannister (1871).
J. Castell-Evans (1903).
E. J. Cox (1886).
C. B. Dudley (1898).
C. Ekin (1864).
J. Fuller (1886).
C. Graham (1862).
H. E. Harrison (1883).
W. H. Hudleston (1871).
S. H. Johnson (1866).
J. J. Kielty (1903).
L. Mond (1872).
F. Norton (1854).
G. E. Perry (1888).
E. A. Pontifex (1848).
T. H. Redwood (1887).
W. B. Roberts (1880).
W. J. Russell (1851).
W. Stewart (1872).
F. Stocks (1874).
C. Thomas (1871).
H. E. Thomas (1874).
Sir T. Wardle (1875).
A. F. Watson (1893).
J. H. Wilson (1878).

The following Fellows have resigned

E. W. Bealey.
H. J. Brown.
T. S. Busher.
E. Catherall.
E. Cleminshaw.
A. J. Cook.
J. W. Daniels.
J. H. Davidson.
F. R. Dudderidge.
E. J. Fairhall.
C. Gordon.
J. H. Gough.
H. W. Harrie.
J. W. Helps.
C. P. Hines.
E. Houghton.
A. Howard.
R. S. Hutton.
A. J. Hyder.
A. James.
W. H. M. Jones.
J. Leicester.
A. G. Levy.
R. D. MacKechnie.
W. Mackean.
A. McMullen.
C. A. MacMunn.
*C. Müller.
J. M. Murray.
P. G. Pennymore.
H. Richardson.
H. E. Richardson.
J. Richardson.
*C. J. Smith.
T. Southern.
W. S. Templeton.
R. Tervet.
A. Tighe.
S. Tolson.
A. J. Webb.
G. H. West.
F. G. Wiechmann.

and Professor Dr. Georg Lunge, whose name has been transferred from the list of Fellows to that of the Honorary and Foreign Members.

The number of those Fellows elected previous to the year 1860 has been diminished still further by the death of Mr. Fletcher Norton, elected on December 18th, 1854, of Mr. Edmund Alfred Pontifex, elected December 4th, 1848, and of our distinguished Past-President, Dr. William James Russell, F.R.S., elected March 3rd, 1851.

The number of Honorary and Foreign Members at the close of

* Included among the seven reinstated Fellows.

1909 was 34. One election has taken place, and the Society has to mourn the loss of Professor Emil Erlenmeyer, and of Professor Julius Thomsen, who passed away early last year, making the total number of Honorary and Foreign Members at December 31st, 1909, amount to 33.

The Council has much pleasure in congratulating the following gentlemen, who, during the past year, have reached their Jubilee as Fellows of the Society:

Prof. Dr. Heinrich Debus, F.R.S.
Mr. Thomas Fogg.
Dr. A. G. Vernon Harcourt, F.R.S.
Mr. Josiah W. Kynaston.
Dr. Hugo Müller, F.R.S.
Mr. Thomas W. Salter.
Mr. John Spiller.

During the year 1909, 300 scientific communications have been made to the Society, 227 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1909 contains 2,219 pages, of which 2,133 are occupied by 236 memoirs, the remaining 86 pages being devoted to the Obituary Notices, the Wolcott Gibbs and Mendeléeff Memorial Lectures, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 222 memoirs, which occupy 2,188 pages.

The Journal for 1909 contains 4,946 abstracts, which extend to 2,040 pages, whilst the abstracts for 1908 numbered 4,978, and occupied 2,112 pages. The abstracts for 1909 may be classified as follows:

PART I.

	Pages.	No. of Abstracts
Organic Chemistry	980	1,781

PART II.

General and Physical Chemistry		953
Inorganic Chemistry		565
Mineralogical Chemistry		144
Physiological Chemistry		577
Chemistry of Vegetable Physiology and Agriculture		304
Analytical Chemistry		622
	1,060	3,165
Total in Parts I. and II.	2,040	4,946

Since the last Annual General Meeting, three Memorial Lectures, dealing with the life-work of deceased Honorary and Foreign Members have been delivered. On the 3rd of June, 1909, Dr. Frank Wigglesworth Clarke paid this tribute to the late Professor Wolcott Gibbs; Sir William Tilden delivered the Mendeléeff Memorial Lecture on October 21st, and Sir Edward Thorpe reviewed the thermochemical and other researches of Professor Julius Thomsen in a discourse given before the Society on February 17th, 1910.

The year 1911 marking the hundredth anniversary of Avogadro's celebrated memoir, the Council has voted a contribution of £10 from the funds of the Society towards the international commemoration of the event. Fellows have been invited also to participate in the celebration of Professor Körner's seventieth birthday, which will be recognised on behalf of the Society by the presentation of an illuminated address of congratulation in May next.

The rapid growth of the Library since the contents of the rooms at Burlington House were valued, has necessitated the preparation of a fresh estimate of replacement cost; this has now been completed, and an arrangement based thereon will be concluded with the Insurance Company.

During the past year the Chemical Society has become indebted to the Society of Dyers and Colourists for the gift of a reproduction in bronze of the plaque by Mr. F. W. Pomeroy, R.A., representing the late Sir William Perkin. Professor Meldola has added to the collection of photographs an interesting one of the Jury (Paris Exhibition, 1900), which included among its members the late Professor Mendeléeff, and the Society has also received valuable gifts of books from Mrs. J. Wilson, Mr. A. Gamble, and Mr. F. Stocks.

In chronological order, Past-Presidents the Rt. Hon. Sir Henry Roscoe, Sir William Crookes, Dr. Hugo Müller, and Dr. A. G. Vernon Harcourt have more than completed fifty years of Fellowship, whilst Professor William Odling, who has now been for sixty-two years a Fellow, and became President in 1873, is the sole survivor of the six Past-Presidents who were entertained to a banquet in 1898. Desiring to do honour to these gentlemen in the name of the Society, the Council, through the President, has invited them to a banquet to be held during the ensuing summer, believing that a considerable number of Fellows will be glad to assist at this interesting commemoration, details of which will be announced forthwith.

With the object of meeting a widely expressed desire, the Report of the International Committee on Atomic Weights will in future, it is hoped, be published in September instead of in January. This will render it immediately useful to College teachers at the beginning of each new Session. In order to adapt the list of amended Atomic

Weights to the requirements of students, it is now printed on paper as well as on cardboard.

The Council desires to place on record its high appreciation of the valuable services rendered to the Society by Dr. M. O. Forster, who now retires from the position of Honorary Secretary, which he has held for the last six years. Dr. Forster has given unsparingly both his time and his energy to the work of the Society, and has ever been active in promoting its highest interests.

The number of books borrowed from the Library during the year 1909 was 1,548, as against 1,339 in the previous year; of these, 347 were issued by post, as against 338 in the preceding year.

The additions to the Library comprise: 142 books, of which 72 were presented, 418 volumes of periodicals (representing 243 journals), and 80 pamphlets, as against 159 books, 412 volumes of periodicals (representing 245 journals), and 36 pamphlets last year.

The income of the Society for the year shows an increase of £252 10*s.* 10*d.* over that of last year, the amounts being £7,387 8*s.* and £7,134 17*s.* 2*d.* respectively, whilst the expenditure has risen from £6,834 15*s.* to £7,028 3*s.* 5*d.* This leaves in the Treasurer's hands a balance of £359 4*s.* 7*d.* on the year's working, which together with the balance of £300 saved in 1908 has enabled the Council to authorise the purchase of £700 Canadian 3½ per cent. stock.

In the balance-sheet for this year there appears for the first time a valuation of the Library, Furniture, Bronzes, Busts, &c. This has been based on a complete inventory which has now been made in order to be used as the basis for the new Fire Insurance Policy which will be arranged in June next, when the present policy expires.

Thanks to the care of the Publication Committee and the Editor, the net cost of the annual publications (taking account of their increased sales) only shows a rise of about £25, and this, be it noted, includes the preparation for the next volume of the Decennial Indexes which is now fairly under way. The cost of indexing no longer appears as a separate item in our accounts, as it has been entirely taken over by the Editor and is included in his salary. There has been a reduction of nearly £100 in the cost of the Annual Reports, whilst house expenses and repairs cost about £50 less than last year. The chief items in the expenditure which are not of annual occurrence are the new cases for the Library costing £93 10*s.*, and the balance of the Dinner account, which was no less than £70 9*s.* 6*d.*

From the Research Fund grants were made amounting in all to £369, and as this year there was the further outlay on the Longstaff Medal and its accompanying Honorarium, the expenditure exceeded the income by £34 17*s.* 1*d.*, this deficit being met from the balance in hand. During the last six years grants have been

made to 183 out of 216 applicants, the total amount applied for having been £2,845, of which £1,673 was granted, and of this £57 has been refunded. In return, 160 papers have appeared in our Transactions, 18 in the Proceedings, and 22 in other journals.

A vote of thanks to the Treasurer, Honorary Secretaries, Foreign Secretary, and Council for their service during the past year was proposed by Dr. BERNARD DYER, seconded by Mr. E. GRANT HOOPER, and acknowledged by Dr. M. O. FORSTER, the retiring Hon. Secretary.

The PRESIDENT then delivered his address, entitled "The Union of Hydrogen and Oxygen in Flame." Dr. A. G. VERNON HARCOURT proposed a vote of thanks to the President coupled with the request that he would allow his address to be printed in the Transactions. The motion was seconded by Sir EDWARD THORPE and carried with acclamation, and acknowledged by the PRESIDENT.

The Scrutators having presented their report, the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President: Harold B. Dixon, M.A., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; A. Vernon Harcourt, M.A., D.C.L., F.R.S.; Raphael Meldola, F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; W. Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.,; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; The Rt. Hon Sir Henry E. Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William A. Tilden, D.Sc., F.R.S.

Vice-Presidents: J. Norman Collie, Ph.D., F.R.S.; J. J. Dobbie, M.A., D.Sc., F.R.S.; M. O. Forster, D.Sc., Ph.D., F.R.S.; F. Stanley Kipping, D.Sc., Ph.D., F.R.S.; A. Liversidge, LL.D., F.R.S.; J. Walker, D.Sc., Ph.D., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: A. W. Crossley, D.Sc., Ph.D., F.R.S.; G. T. Morgan, D.Sc.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: Julian L. Baker; George T. Beilby, F.R.S.; William A. Bone, D.Sc., Ph.D., F.R.S.; Adrian J. Brown, M.Sc.; Julius B. Cohen, Ph.D., B.Sc.; Charles E. Groves, F.R.S.; J. T. Hewitt, M.A., D.Sc., Ph.D.; H. R. Le Sueur, D.Sc.; Alex. McKenzie, D.Sc., Ph.D.; J. C. Philip, D.Sc., Ph.D.; Sir Boverton Redwood, D.Sc.; A. E. H. Tutton, M.A., D.Sc., F.R.S.

Thursday, April 21st, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., F.R.S., President, in the Chair.

It was announced that the Council had appointed the following Committees for 1910–1911:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William A. Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William A. Tilden, and the Officers.

Library Committee: Messrs. E. C. C. Baly, B. Dyer, W. Gowland, A. Harden, C. A. Keane, R. Meldola, E. J. Mills, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, J. Wade, The Editor, and the Officers.

Publicatio Committee: Messrs. M. O. Forster, C. E. Groves, J. T. Hewitt, A. McKenzie, R. Meldola, Sir William Ramsay, Sir Edward Thorpe, and the Officers.

Research Fund Committee: Messrs. H. B. Baker, G. T. Beilby, J. N. Collie, A. D. Hall, A. Liversidge, R. Meldola, R. Messel, Sir Alexander Pedler, W. J. Pope, J. E. Reynolds, and the Officers.

The President stated that on the occasion of the Celebration of Professor Körner's Seventieth Birthday, to be held on May 15th, 1910, the following congratulatory Address would be presented on behalf of the Society:

PROFESSOR WILHELM KÖRNER:

The President, Officers, and Council of the Chemical Society gladly take advantage of the opportunity afforded by your Seventieth Birthday to offer you the felicitations of English Chemists on the occasion.

It is now so usual to consider the constitution of benzene as established, that few are mindful of the times when the study of the immediate derivatives of the hydrocarbon was regarded by Chemists as of the first importance. In those days, you were the most active of the pioneer workers. It is universally known that the all-significant hexagon formula is the product of the genius of Kekulé, but some Chemists need to be reminded that yours were the hands which furnished the larger part of the experimental material required to give logical precision and practical value to Kekulé's conception.

Gifted with unusual experimental skill, while Assistant to Kekulé

in Ghent, you prepared a remarkably beautiful series of derivatives of benzene, which were shown at the Exhibition of 1867 in Paris; for this collection, on the recommendation of your patron Stas and at the instigation of Dumas, you received special recognition from the hands of the late Emperor of the French.

The results of your labours were ultimately described in a comprehensive Italian monograph published in 1874; they were made known to English Chemists early in 1876, in an abstract of record length published in the Journal of our Society. In this memoir, you developed the method of determining the position of the radicles in the derivatives of benzene, by reference to certain simple di-derivatives, which has since been the accepted method. The Society that once numbered Faraday, the discoverer of benzene, among its Fellows, has peculiar pleasure in acknowledging the very special value of your work.

Signed on behalf of the Chemical Society,

(*Signed*) HAROLD B. DIXON, *President.*
ALEXANDER SCOTT, *Treasurer.*
M. O. FORSTER, } *Honorary*
ARTHUR W. CROSSLEY, } *Secretaries.*
HORACE T. BROWN, *Foreign Secretary.*

Dated this Eighteenth Day of March, One Thousand, Nine Hundred and Ten.

Certificates were read for the first time in favour of Messrs.:

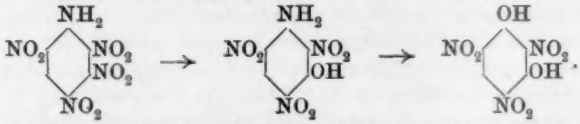
Geoffrey Alfred Bracewell, 20, Heaton Grove, Bradford.
Alexander Scott Dodd, B.Sc., 173, Bruntsfield Place, Edinburgh.
James Grieve, 127, Buchanan Street, Glasgow.
John Haycock, Great Glen, nr. Leicester.
John Huck, M.A., The Foundation, St. Bees School, Cumberland.
Edward Talbot Paris, 15, Montpellier Villas, Cheltenham.
Roland Edgar Slade, M.Sc., Muspratt Laboratory, The University, Liverpool.
James Harry Smith, 5, Turks Road, Radcliffe, Lancs.
Thomas May Smith, "Walla Crag," Osborne Road, Romford.
Ferdinand Bernard Thole, B.Sc., 23, Cowper Avenue, East Ham, E.
Frederick George Williams, 5, Mayhill Road, Charlton, S.E.

Of the following papers, those marked * were read :

*86. "Tetranitroaniline."
By Bernhard Flürscheim and Theodor Simon.

When *m*-nitroaniline, 2 : 3-dinitroaniline, 3 : 4-dinitroaniline, or some of their derivatives are nitrated, a good yield of a tetranitroaniline is obtained, the yield being about two-thirds of the theoretical.

Tetranitroaniline separates from acetic acid in yellow crystals, melting and decomposing at 212°. The meta-nitro-group is quantitatively and instantaneously removed by sodium acetate in aqueous acetone solution at the ordinary temperature, a trinitroaminophenol, melting at 174—175°, being formed. Since the latter is converted into trinitroresorcinol by boiling with aqueous potassium hydroxide, the constitution and changes are expressed by the formulæ :



Other reagents, such as hydrochloric acid or sodium chloride in aqueous acetone solution, boiling aqueous sodium acetate or bicarbonate, phenol, etc., also remove the nitro-group in the 3-position. Tetranitroacetanilide is similarly transformed into trinitroacetylaminophenol, which can also be obtained from trinitroaminophenol by partial hydrolysis of its diacetyl derivative.

Preliminary experiments have also shown that when 3 : 5-dinitroaniline is similarly nitrated, a nitroamine is first formed, which is subsequently converted into a compound which may be pentanitroaniline.

Discussion.

Dr. Morgan said that Mr. Clayton and he had noticed that when dimethyl-*p*-toluidine, dissolved in concentrated sulphuric acid, was treated with excess of nitro-sulphuric acid, 2-nitrodimethyl-*p*-toluidine was obtained, but on pouring the product into water at 30° the diluted nitric acid produced further nitration to dinitrodimethyl-*p*-toluidine. This result corresponded with Dr. Flürscheim's observations on the nitration of *m*-nitroaniline and its derivatives with nitric acid of varying strengths, and it would be of interest to know whether the author had any explanation to offer of the singular fact that the weaker acid was the more efficient nitrating agent.

Replying to the President's question as to the sensitiveness of the meta-nitro-group, Dr. Flürscheim said that, according to Blanksma, tetranitrophenol also loses a nitro-group when boiled with water, but

that the reaction of tetranitroaniline with neutral salts, at the ordinary temperature, had not been observed with tetranitrophenol. In connexion with the reaction mentioned by Dr. Morgan, no explanation was offered why a second nitro-group should enter the meta-position with regard to the amino-group more readily than did the first nitro-group. In reply to Dr. Forster's suggestion, Dr. Flürscheim stated that no attempt had been made to diazotise amines by means of the reactive nitro-group of tetranitroaniline, but that, in view of the reaction with phenol, it would probably be possible to do so.

***87. "A method for the approximate estimation of small quantities of lead." By A. G. Vernon Harcourt.**

A quick approximate test of the amount of sulphur in coal gas was brought into use by the author many years ago. The gas, in which the sulphur was present as hydrogen sulphide, was led through an alkaline solution of lead, mixed with syrup, until the brown colour matched a standard. Having recently to arrange for the estimation of very small quantities of lead which are breathed in as dust by some of the workers in potteries, he has reversed the above process, and estimated the amount of lead by comparing with a set of standards the coloration caused by an excess of hydrogen sulphide. Since the liquid coloured by lead sulphide fades gradually in daylight, standards the colour of which is fast are made by mixing the sulphates of copper, cobalt, and ferric iron, and diluting the mixture to match the colours given in a volume of 50 c.c. by quantities of lead varying progressively from 0·5 to 25 centimilligrams. Such dilute solutions are not coloured on addition of hydrogen sulphide in presence of even a small excess of the nitric acid used for their extraction, but a brown tint, paler or deeper according to the quantity of lead, appears on further addition of sodium acetate. To prevent precipitation of lead sulphide there must be sugar in the liquid and but little agitation.

The estimations are made by placing the cylinder, in which the lead sulphide has been formed, on a sheet of white paper between the standards—consisting of the same volume of liquid sealed up in similar cylinders—which it most resembles, and comparing the depth of colour of the disks which form the upper surfaces of the liquids. If, for example, the lead sample is rather darker than "7," but not so dark as "10," the conclusion is that the amount of lead present is more than 7, but less than 10, centimilligrams. The total volume of dilute acid used to extract lead from a weighed amount of dust or frit or glaze being known, and also the volume of the part taken for testing, the percentage of lead, or lead oxide, dissolved from the sample is calculated.

Discussion.

Dr. Veley remarked that as a solution coloured by lead sulphide could be matched against a solution made up of coloured sulphates of certain metals, the sulphide must be in a state of so-called pseudo-solution, or, what might be the same thing, in a colloidal condition. The experience of Dr. Harcourt that gentle stirring produced uniformity in the solution, but that violent agitation caused a distinct sediment or precipitate, appeared to favour this view. Dr. Harcourt's observations accorded with his own, the result of many hundreds of colour observations, that daylight from a north window was, on the whole, the most uniform illuminant, although for matching clear-coloured solutions, a gas flame with mantle was less satisfactory.

It was desirable again to point out that in all tintometer experiments the personal error was of a twofold character, namely, first, that of one person with another, and, secondly, that of one person with himself according to his state of health. The error from the latter was often greater than that from the former.

The President asked whether the author had detected lead in the dust of the atmosphere of pottery works.

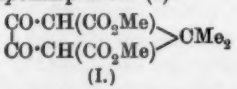
Dr. Harcourt, in reply to the President, stated that he had not analysed dust in the atmosphere of a pottery works, but lead could easily be estimated in an artificial dust prepared for special purposes.

*88. "Komppa's synthesis of camphoric acid."

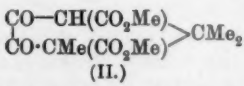
By Gustave Louis Blanc and Jocelyn Field Thorpe.

In the year 1903 (*Ber.*, **36**, 4332), Komppa published the preliminary notice of his synthetical preparation of camphoric acid. Last year (*Annalen*, 1909, **368**, 126; **370**, 209) he published the full experimental details involved in the synthesis.

In the last of these papers (*Annalen*, **370**, 220) he described the preparation of a compound which he called methyl diketocamphorate, and to which he assigned the formula (II). He prepared this compound by the action of sodium methoxide and methyl iodide on methyl diketo*apo*camphorate (I):



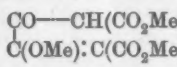
(I.)



(II.)

This substance (II), which was the basis of his synthesis, is a well-defined, crystalline compound, melting at 85—88°. It was from the pure crystalline material that Komppa prepared camphoric acid (*loc. cit.*, p. 221).

The authors have now found that the substance melting at 85—88° is not, as Komppa supposed, the *C*-methyl derivative (II), but the *O*-methyl ether corresponding with the formula :

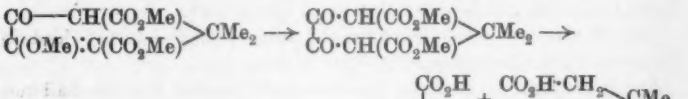


The evidence in support of this view is as follows : when treated with cold aqueous potassium hydroxide, the substance melting at 85—88° is slowly hydrolysed, yielding :

(*a*) An amount of methyl diketo*apo*camphorate (I) melting at 116°, corresponding with 50 per cent. of the substance melting at 85—88° hydrolysed.

(*b*) An amount of *ββ*-dimethylglutaric acid melting at 101° from the residue corresponding with a further 40 per cent. of the above derivative hydrolysed.

The substance melting at 85—88° is therefore hydrolysed to the extent of 90 per cent. in accordance with the scheme :



It would be in the highest degree improbable that a substance having the *C*-methyl constitution (II) would undergo hydrolysis in this manner, and the authors are therefore of the opinion that Komppa was in error in supposing that he obtained camphoric acid from the compound melting at 85—88° on reduction and hydrolysis.

Discussion.

Dr. Pickles asked if the authors had carried out a methoxyl determination on the original compound melting at 85—88°. Supposing that the compound had the formula which Komppa suggested, might it not be possible that in the subsequent treatment to which it had been subjected, before it was identified as the *O*-methyl ether, the methyl group had wandered from the carbon atom adjoining the carboxyl group ?

Dr. Thorpe replied that, as the methoxy-derivative so readily regenerated methyl diketo*apo*camphorate on treatment with cold alkali, M. Blanc and he were of the opinion that no useful purpose would be served by repeating the process of reduction with sodium amalgam in alkaline solution, used by Komppa.

*89. "Experiments on the Walden inversion. Part IV. The interconversion of the optically active phenylmethylglycollic acids." By Alex. McKenzie and George William Clough.

The authors have resolved *r*-phenylmethylglycollic acid into its optically active isomerides, and have also prepared *d*- and *l*-α-chloro-α-phenylpropionic acids. The displacement of chlorine in the latter compounds by the hydroxy-group has been investigated from the point of view of the Walden inversion.

*90. "Studies in fermentation. Part III. The rôle of diffusion in fermentation by yeast cells." By Arthur Slator and Henry Julius Salomon Sand.

Facts of a directly experimental nature lead to the belief that during the fermentation of a sugar by yeast, diffusion usually supplies the latter with material so rapidly that convection currents in the solution do not play any part in determining the apparent velocity of the reaction. An investigation has now been carried out by means of the apparatus described previously, in order to determine the limiting conditions under which convection currents would begin to become a controlling factor of the rate of the process. These have been deduced from the following formulæ, which were shown to represent with sufficient accuracy the changes of concentration in a stationary solution in which uniformly distributed yeast cells are operative: $C - C_0 = 3F/8\pi\kappa R$ and $C_1 - C_0 = F/8\pi\kappa R$. In this expression, C represents the concentration of the sugar at any point of the solution not in the immediate vicinity of a yeast cell, C_1 the concentration on the surface of a cell, C_0 the concentration at its centre, R its radius, and κ the diffusion coefficient of the sugar. F is the amount of sugar fermented per cell per unit of time, and was determined by experiment to be approximately 3×10^{-14} g/sec. at 30°.

Discussion.

Dr. Horace Brown fully recognised the importance of knowing the particular conditions under which diffusivity becomes a factor in limiting the specific activity of the yeast-cell. The results of an inquiry which he had made some time ago, employing the electrostatic analogy, were in substantial agreement with the conclusions of the authors, but he differed in some important points of detail, and considered that it was unnecessary to make any assumptions as to the particular mode in which absorption of the sugar takes place within the cell. The phenomena of steady diffusion induced by an

absorbing sphere in a diffusive field are closely analogous to those presented by an insulated conductor of the same dimensions which has received an electrical charge. In the former case, when the permanent state has been reached, there are produced around the sphere a series of concentric shells of the diffusate which in distribution, although with opposite sign, correspond with the shells of equipotential in the dielectric surrounding the charged sphere. The variations in the gradient of concentration of the diffusate, as measured along the lines of flux, correspond exactly with the variations in the gradient of potential around the charged sphere, measured along the lines of force. In the special case of a spherical yeast-cell immersed in a solution of sugar, if the concentration of the diffusate at a remote point is represented by ρ, and that at the immediate surface of the cell by ρ_1, then the gradient of concentration at the surface, on which the rate of absorption depends, will be represented by $\frac{\rho - \rho_1}{r}$, r being the radius of the cell. If F be taken as the total absorption in unit time, then:

$$F = 4\pi r^2 \frac{(\rho - \rho_1)}{r} k = 4\pi r(\rho - \rho_1)k,$$

k being the coefficient of diffusivity of the sugar.

When actual values in *C.G.S.* units are substituted, and F has been experimentally determined, all the problems given by the authors can be solved by simple mathematical treatment, and without the necessity of making any assumptions as to the particular mode in which the sugar is dealt with in the interior of the cell or the amount of resistance introduced by the cell-membrane.

His (the speaker's) determinations of the amount of sugar fermented by a single yeast-cell in a second of time at a temperature of 17—20° led to a value of F of $0{\cdot}92 \times 10^{-14}$ gram. The authors of the paper had found $3{\cdot}0 \times 10^{-14}$ for a temperature of 30°. Taking into account the temperature-coefficient, which had been previously determined by Dr. Slator, these two results were almost identical.

One of the problems presented by the authors was to ascertain the minimal concentration, ρ, of a sugar solution which would be just sufficient to supply the yeast-cell with its requirements by diffusion only. From the above formula, and taking the value of F as $3{\cdot}0 \times 10^{-14}$, it follows that:

$$\rho - \rho_1 = \frac{3{\cdot}0 \times 10^{-14}}{4\pi r k} = 8{\cdot}52 \times 10^{-7},$$

that is to say, the minimal gradient of concentration at the surface of the cell must be 0·85 milligram per litre if these conditions are to be fulfilled. If the absorption of the sugar were complete at the

exterior surface of the cell, then ρ_1 would be zero, and the required minimal concentration of the sugar solution, ρ, would be 0·85 milligram per litre. We know, however, that the metabolism of the sugar takes place within the cell, and therefore that ρ_1 must have a positive value, which, however, cannot exceed 0·85 milligram per litre if the gradient is to remain constant, and ρ is to be at a minimum.

The values ρ and ρ_1 can be evaluated by looking at the problem somewhat differently. Let it be supposed that all the fermentative processes are reversed, the activity of the cell as measured by F remaining the same. The cell will now emit sugar into the surrounding medium, and when ρ is at a minimum, that is, zero, the concentration ρ_1 at the exterior surface of the cell must equal the gradient, that is to say, must be equal to 0·85 milligram per litre if the outward flow is maintained at F. This must also represent the minimal surface concentration when the cell is absorbing sugar and ρ is also at a minimum; hence, under these latter conditions, $\rho = 2\rho_1 = 1{\cdot}70$ milligrams per litre, instead of 1·29 milligrams as found by the authors.

By the same reasoning it could be shown that with maximal stirring a concentration of 0·85 milligram per litre ought to be sufficient to supply the cell with its full requirements.

In this way it seems possible to avoid all complications introduced by having to take into account internal diffusion, the rate of metabolism and diffusion within the cell being included in the value of ρ_1, which can be evaluated by simple means.

Apart from all calculations of this kind, it is evident that diffusion can play but a very small part in limiting the activity of the cell when we consider the very large surface area represented by a relatively small amount of yeast. 0·1 Gram of pressed yeast, corresponding with about 0·025 gram of dry substance, contains about 4×10^8 cells, representing a surface area of 804 sq. cm. When this yeast is actively fermenting at 30°, this large area is called upon to deal with not more than about 43 milligrams of sugar per hour.

Dr. Slator, in reply, expressed the opinion that it was not possible to calculate these limiting conditions unless diffusion in the yeast cell itself was taken into consideration.

*91. "Syntheses of *p*-hydroxyphenylethylalkylamines." By George Stanley Walpole.

The methylamino- and ethylamino-homologues of *p*-hydroxyphenylethylamine have been prepared in order that their physiological properties might be examined. The starting point was *p*-methoxyphenylethylamine and the series of reactions employed may be

represented by the following scheme: $MeO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NH_2 \rightarrow MeO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NHAc \rightarrow MeO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NAc(Alk) \rightarrow HO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NH(Alk)$.

Another series of compounds was prepared similar to the above, but in which the benzenesulphonyl group replaced the acetyl group whenever it occurred. In chemical and physical properties, p-*hydroxyphenylethylmethylamine* (m. p. 130°) and p-*hydroxyphenylethylethylamine* (m. p. 157—158°) resemble the parent substance, *p*-hydroxyphenylethylamine, very closely.

The *hydrochlorides* melt at 148·5° and 184—185° respectively. A *dibenzoyl* derivative, melting at 99°, and a platinichloride, melting at 205°, were prepared from the hydrochloride of *p*-hydroxyphenylethylmethylamine. The platinichloride corresponds exactly with the data given by Blau for the platinichloride prepared from the base obtained by the destructive distillation of surinamine. There is no longer room for doubt, therefore, that the latter substance is, as supposed, methyltyrosine.

92. "The condensation of anisaldehyde with resorcinol." By Frank George Pope and Hubert Howard.

In continuation of their previous work (*Trans.*, 1910, **97**, 78), the authors have condensed anisaldehyde with resorcinol, and have prepared 2 : 4-*dihydroxy-4'-methoxybenzhydrol* and its derivatives. 10-*Hydroxy-7-phenyldihydro-aβ-phenonaphthacridine* was also described.

93. "The influence of persulphates on the estimation of hydrogen peroxide with permanganate." By John Albert Newton Friend.

The author showed a few years ago (*Trans.*, 1904, **85**, 547, 1533; 1905, **87**, 738, 1367, and 1906, **89**, 1092) that, in ordinary circumstances, a correct estimate of hydrogen peroxide in the presence of potassium persulphate is not obtained by titration with permanganate, for the amount of the latter used always falls short of that required theoretically. It was further shown that, for every molecule of peroxide not accounted for by the permanganate, a molecule of persulphate disappears. This suggests that the reaction $H_2O_2 + K_2S_2O_8 = K_2SO_4 + H_2SO_4 + O_2$ is also taking place during the titration. As, however, it proceeds with extreme slowness in ordinary circumstances, the author assumed that it is here "catalytically accelerated by some oxide of manganese formed during titration."

In a recent communication (*Oesterr. Chem. Zeit.*, 1910, No. 3),

Dr. A. Skrabal, whilst acknowledging the correctness of the experimental work, has suggested another interpretation. He says: "Nach unserer Meinung dürfte die von Friend beobachtete Erscheinung dadurch besser charakterisiert werden, dass man dieselbe in die Klasse der induzierten Reaktionen verweist. Wir nehmen also an, dass die Reaktion

$$5H_2S_2O_8 + 2KMnO_4 + 2H_2O = K_2SO_4 + 2MnSO_4 + 7H_2SO_4 + 5O_2$$

welche für sich allein nicht oder nur ausserordentlich langsam verläuft, durch die freiwillige und rasche Reaktion zwischen Hydroperoxyd und Permanganat induziert wird."

If, however, such were the case, it is clear that more permanganate would be required in the titrations than theory demands for the decomposition of the peroxide, the excess being measured by the extent to which the reaction between permanganate and persulphate is induced. Since less permanganate is actually required, such an explanation is seen to be untenable.

In a private communication, Dr. Skrabal has kindly given the author permission to state that he acknowledges the error, which arose through his consulting abstracts of the author's papers instead of the originals. He prefers, however, to regard the reaction which takes place between the persulphate and peroxide as "induced" rather than as catalytically accelerated by an oxide of manganese. This is merely a question of choice of terms, however, for induction is very frequently merely a special case of catalysis, neither of which is at present understood.

94. "**Amido-oximes and thioamides.**" **By William Fraser Russell.**

The conversion of thioamides into amido-oximes by the action of hydroxylamine is restricted to those thioamides of the type R·CS·NHR, those of the formula R·CS·NRR scarcely being acted on by hydroxylamine under the same conditions. The author has prepared a number of thioamides of the second type, and the effect of hydroxylamine on them was described.

95. "**Preparation of the acyl derivatives of the aldehyde-cyanohydrins. Part II.**" **By Oliver Charles Minty Davis.**

The reaction between acyl chlorides, aldehydes, and aqueous potassium cyanide (*Trans.*, 1909, **95**, 1403) has been further investigated, and found to be quite general for all types of aldehydes.

Benzoyl-lactonitrile, *α-benzoyloxyisohexonitrile*, and *benzoyloxyoctonitrile* have been prepared; they are oils of high boiling points.

With the exception of acetone, it was found impossible to obtain compounds from ketones analogous to the aldehyde-cyanohydrin derivatives.

From acetone, *benzoyloxyisobutyronitrile*, m-*nitrobenzoyloxyisobutyronitrile*, and *carbethoxyisooxybutyronitrile* were obtained.

The reactions of the acylaldehyde-cyanohydrins have also been investigated.

96. "Some derivatives of tetramethyl ferrocyanide." By Ernald George Justinian Hartley.

Dry potassium ferrocyanide reacts readily with methyl sulphate at 80—90° with the formation of potassium methyl sulphate and a substance which could not be obtained pure, but probably has the composition $Me_4FeC_6N_6,2MeSO_4,2MeHSO_4$.

This, on further heating or on keeping in a vacuum, gives off methyl sulphate, and is converted into $Me_4FeC_6N_6,Me_2SO_4,H_2SO_4$, a very stable substance soluble in water and methyl alcohol, and crystallising well from the latter solvent. It gives none of the usual reactions for iron or for ferro- or ferri-cyanides, but on ignition leaves a residue of almost pure ferric oxide.

Both the above compounds give the same platinichloride as a very insoluble, crystalline precipitate from aqueous solutions. It has the composition $Me_6FeC_6N_6PtCl_6$. The formation of the $MeHSO_4$ groups in the first-mentioned substance has not yet been satisfactorily explained, but is probably due to moisture introduced during the experiment. Preliminary experiments show that potassium ferricyanide reacts in a similar way, but the products have not yet been analysed.

97. "The molecular refraction of thiocyanates and other salts." By Augustus Edward Dixon and John Taylor.

From previous observations (Hawthorne, *Trans.*, 1906, **89**, 556; Dixon and Taylor, *ibid.*, 1908, **93**, 2153), it appears that, as calculated by the formula

$$M_D = \frac{p(\mu_D - 1)}{d\frac{t^\circ}{4^\circ}},$$

the mean refraction value of the group ·SCN in organic combinations is about 23·3 units; it is now shown that the refraction effect of this group in the thiocyanates of sodium, potassium, ammonium, calcium, and aluminium is considerably higher, the mean value being about 26 units. In this respect the ·SCN group resembles the halogens, which give higher values in metallic salts than in organic combinations.

The refraction value of the group C_2O_4 was found to be substantially the same in potassium oxalate and in ethyl oxalate, the mean numbers being 21·6 and 21·8 respectively. For SO_4 in sodium, potassium, and ammonium sulphates, the mean value was 16·89; in various alkyl sulphates, 17·53, and in ethyl sulphate, 18·91; this was the only case noted in which an acid residue gives a lower value in metallic salts than in esters.

Silicon thiocyanate showed in its chemical behaviour no sign of being a thiocarbimide: this agrees with the conclusion of Emerson Reynolds (*Trans.*, 1906, **89**, 397).

98. "Estimation of carbon in iron and steel and in iron alloys by direct combustion." By Thomas Ernest Hull.

In the process which is often recommended for determining the carbon-content of iron alloys (ferromanganese, ferrosilicon, silicospiegel, etc.), namely, to ignite the drillings with powdered and ignited lead chromate, the author finds that, at the high temperature involved (800—960°), the lead chromate is decomposed into chromic oxide and basic lead chromate, and that the former is not retained in the usual drying apparatus, and consequently is absorbed by the potash in the potash-bulbs, thus leading to a high result in the amount of carbon found. There is no doubt that the decomposition of the lead chromate is solely due to the high temperature employed.

The following method for the determination of carbon in iron and steel is found to be both simple and accurate. The finely-drilled sample is weighed into an asbestos boat (made from strips of moistened asbestos millboard), which has been previously heated to full redness, and into which a layer of recently ignited silver sand has been introduced. The ignition in oxygen is carried out at 900—960°, the residual gases are dried by passing through concentrated sulphuric acid contained in a Mohr's bulb, and the carbon dioxide is absorbed by 30 per cent. potassium hydroxide solution in the usual weighed bulbs. In the case of ferromanganese, etc., it is advisable to ignite the finely-powdered sample with zinc oxide. The porcelain or silica-glass tube is always packed loosely with asbestos and copper oxide.

99. "2-Methyl-1 : 3-benzoxazine-4-one and related derivatives." By William Longton Hicks.

Salicylamide and acetaldehyde (paraldehyde) condense under the influence of hydrogen chloride at 80° to form 2-*methyl*-1 : 3-*benzoxazine*-4-*one*, $C_6H_4<\begin{matrix}CO\cdot NH\\ O—CHMe\end{matrix}$. The oxazine ring may be ruptured by

means of sodium hydroxide in pyridine solution, the resulting compound being *syn-ethylidenesalicylamide*, $C_6H_4<^{CO\cdot N:CHMe}_{OH}$, which readily regenerates the oxazine on melting.

The corresponding *anti*-form shows no such labile properties.

100. "The examination of the atmosphere at various altitudes for oxides of nitrogen and ozone." By Walter Hayhurst and John Norman Pring.

Methods were devised to carry out accurately a qualitative examination of the atmosphere for the presence of ozone and oxides of nitrogen at various altitudes. Experiments were made systematically on and above Glossop Moor, in Derbyshire, during three or four months in summer, and were supplemented by a number of tests on sea- and mountain-air at various places in this country. It was found that oxides of nitrogen were always present in quantities which vary largely from time to time, and that the amount of ozone was, in every case, too small to be detected in the experiments conducted at ground level and at intermediate altitudes (up to 8000 feet). It was shown, in consequence, that the amount of ozone is less than 0·003 milligram in the quantity of air dealt with in each experiment (between 1 and 10 cubic metres).

Experiments at very high altitudes, ranging up to ten miles, were carried out with the help of free balloons, and in these the presence of small quantities of ozone, averaging about 0·2 milligram in 0·1 to 0·3 cubic metre of air, was detected; the quantity of oxides of nitrogen was found to be rather less.

101. "Derivatives of *S*-alkylphenazothionium." By Edward de Barry Barnett and Samuel Smiles.

Whilst thiodiphenylamine and methyl iodide when heated together yield the *N*-methyl derivative, these reagents in presence of mercuric iodide at the atmospheric temperature furnish the methyl-sulphonium iodide. This substance reacts with silver oxide, yielding S-*methylphenazothionium*.

102. "Preparation of substituted indoles from benzoin and secondary arylamines." By Marion Brock Richards.

Japp and Murray (*Trans.*, 1894, **65**, 889) showed that by heating benzoin with primary arylamines in presence of zinc chloride or of the hydrochloride of the amine, 2 : 3-diphenylindoles could be prepared.

The author now finds that, by employing secondary in place of primary arylamines, substituted diphenylindoles may be obtained. Thus by the interaction of benzoin and methylaniline in presence of zinc chloride or of methylaniline hydrochloride, 2 : 3-diphenyl-1-methylindole is formed, according to the equation :

$$C_6H_5\cdot NHMe + COPh\cdot CHPh\cdot OH = C_6H_4\langle \begin{matrix} NMe \\ CPh \end{matrix} \rangle CPh + 2H_2O.$$

In like manner, by employing other arylamines, corresponding diphenylindoles have been prepared.

103. "**The interaction of hydrogen and chlorine. The nature of photochemical inhibition.**" **By David Leonard Chapman and Patrick Sarsfield MacMahon.**

The nature of photochemical inhibition was discussed. Experiments on the inhibitive influence of ozone and chlorine dioxide on the interaction of chlorine and hydrogen in light (of which a preliminary account has already appeared) were described in detail. A description was also communicated of experiments which showed that the influence of chlorine monoxide on the rate of combination of hydrogen and chlorine is inappreciable.

104. "**A new synthesis of thioxanthone and its derivatives.**" **By Eric Gordon Davis and Samuel Smiles.**" **(Preliminary note.)**

o-Carboxybenzenesulphinic acid, which is prepared by reducing the chloride of *o*-sulphobenzoic acid with sodium sulphite, may be condensed with benzene, naphthalene, or their derivatives in presence of dehydrating agents, yielding the corresponding thioxanthones. The preparation of *o*-carboxybenzenesulphinic acid is troublesome, but it is not necessary directly to prepare the acid in order to obtain the desired thioxanthone. Thus thiosalicylic acid in presence of suitable oxidising agents may be directly condensed with aromatic substances, giving the compounds in question. The yields obtained by the latter method are between 80 and 90 per cent. of the theoretical. A more complete investigation of the reaction and its products is now being made.

105. "**The action of phosphorus pentachloride on dibenzamide.**" **By Arthur Walsh Titherley and Elizabeth Worrall.**

Dibenzamide in presence of chloroform or ether reacts readily with phosphorus pentachloride, yielding *a*-chloro-*N*-benzoylbenzimide, $C_6H_5\cdot CCl{:}NBz$, identical with the product of the action of phosphorus

pentachloride on α-benzilmonoxime (Beckmann, *Annalen*, 1897, **296**, 279). α-Chlorobenzoylbenzimide readily undergoes fission above 100° into benzoyl chloride and benzonitrile, and with boiling water, benzoic acid and benzonitrile are formed. On the other hand, by the action of cold water for four or five weeks, or atmospheric moisture at 100° for twenty-four hours, much dibenzamide is produced, together with benzoic acid and benzonitrile, derived by simultaneous fission. Dibenzamide is also produced in good yield by treatment with cold concentrated sulphuric acid and subsequent dilution with water.

106. "Amphoteric metallic hydroxides. Part II." By John Kerfoot Wood.

The author has continued his investigations of the basic and acidic characters of various metallic hydroxides (*Trans.*, 1908, **93**, 411). The hydroxides now examined are those of zinc, glucinum, and lead. It is found that lead hydroxide is both the strongest acid and strongest base; glucinum hydroxide is the weakest base, and zinc hydroxide the weakest acid. The order of acidity agrees with that arrived at by Hantzsch by other methods (*Zeitsch. anorg. Chem.*, 1902, **30**, 302). The author agrees with Hantzsch in considering the formula of sodium plumbite to be Pb(OH)ONa, but differs in his views as to the formula of the salt present in a solution of sodium zincate. The form of the curve showing the solubility of zinc hydroxide in solutions of sodium hydroxide of varying concentration points to sodium zincate having the formula $Zn(ONa)_2$. Glucinum forms a salt of analogous composition to that of sodium zincate, but there is also some evidence in support of the existence of a compound having the formula

Gl(OH)ONa.

107. "The action of methyl *tert.*-butyl ketone on ketols. Part I." By Alfred Archibald Boon.

The author has found that methyl *tert.*-butyl ketone does not condense in the presence of potassium cyanide with furoin; but with benzoin a γ-diketone ($C_{20}H_{22}O_2$) was obtained after prolonged action. This compound is almost colourless, soluble in most organic solvents, and melts at 110—111°. It forms a monoxime and a dioxime; the latter decomposes at its melting point (210°).

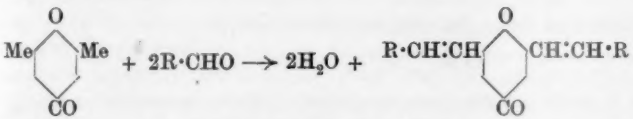
Only one substance, although two others appear to be formed at the same time, was isolated in the pure state when phenylhydrazine was allowed to act on the γ-diketone. This compound, 1-*anilino*-2-tert.-*butyl*-4 : 5-*diphenylpyrrole* or 1 : 3 : 4-*triphenyl*-6-tert.-*butyldihydropyridazine*, melts at 167—168°, and was obtained in very small amount.

The pyrrole-red reaction was given by the γ-diketone, and from it was obtained: 2-*tert.*-butyl-4:5-diphenylfuran, $C_{20}H_{20}O$, m. p. 68—69° (*Trans.*, 1904, **85**, 1497), and the following pyrrole derivatives: a *compound*, $C_{20}H_{21}N$, m. p. 98—99°, and 1-*phenyl*-2-tert.-*butyl*-4:5-*diphenylpyrrole*, m. p. 202—203°.

Several attempts were made to prepare a thiophen derivative from the compound $C_{20}H_{22}O_2$, but without success. From the author's experiments it would appear that the *tert.*-butyl group has some direct influence on the formation of the thiophen and furan derivatives.

108. "Contributions to our knowledge of oxonium compounds." (Preliminary note.) By Alfred Archibald Boon, Kenneth McKenzie, and John Fountain Reid.

Aldehydes can be condensed with dimethylpyrone, giving coloured bases, which form intensely coloured oxonium salts with acids. From furaldehyde a canary-yellow base (m. p. 200°) was obtained, and from benzaldehyde, a pale yellow compound (m p. 169°). The salts are either bright red or bright yellow. The study so far indicates that the colour of the salts depends on the nature of the aldehyde used in condensation, as well as that of the acids employed in their production. The condensation takes place according to the following scheme:



The investigation is being continued with aldehydes and similar compounds both from the chemical as well as the physico-chemical point of view; more particularly the determination of the affinity values of these bases is contemplated.

109. "The effect of contiguous unsaturated groups on optical activity. Part V. Physico-chemical evidence of the structure of 'α-disulphoxides.'" By Thomas Percy Hilditch.

The possibility of applying the known relations between optical rotatory power and constitution to determining the structure of organic compounds was discussed.

An attempt has been made to decide between the alternative formulæ $R{\cdot}SO_2{\cdot}S{\cdot}R$ and $R{\cdot}SO{\cdot}SO{\cdot}R$ for the compounds known as "disulphoxides." The polarimetric examination of *dicamphoryl-β-*

disulphoxide, methyl- and n-*butyl-camphoryl-β-disulphoxides*, and *sodium camphor-β-thiosulphonate* indicates that whilst compounds containing identical alkyl groups, R,R, exist undoubtedly in the symmetrical form (true disulphoxides), those in which the two groups R,R′ are not the same may exist in the thiosulphonic form (when R differs widely in nature or mass from R′) or in the true disulphoxide form (when R approximates to R′). No evidence of transitional forms has, however, been obtained. Additional evidence has been drawn from the behaviour of disulphoxides towards alcoholic hydrogen chloride.

110. "The action of phosphorus pentachloride on some unsaturated compounds." By Reginald William Lane Clarke.

Piperonylacrylic acid (3 : 4-methylenedioxyphenylacrylic acid) when treated with phosphorus pentachloride at 160° yields *α : β-dichloro-3 : 4-dichloromethylenedioxyphenylpropionyl chloride*,

$$CCl_2\langle{}^{O}_{O}\rangle C_6H_3\cdot CHCl\cdot CHCl\cdot COCl,$$

showing that not only are the hydroxyl group and the two methylene hydrogen atoms replaced by chlorine, but also that the substance unites with chlorine at the ethenoid linking. From this substance *αβ-dichloro-3 : 4-carbonyldioxyphenylpropionic acid*,

$$CO\langle{}^{O}_{O}\rangle C_6H_3\cdot CHCl\cdot CHCl\cdot CO_2H,$$

α-chloro-3 : 4-carbonyldioxyphenylacrylic acid,

$$CO\langle{}^{O}_{O}\rangle C_6H_3\cdot CH{:}CCl\cdot CO_2H,$$

and *α-chloro-3 : 4-dihydroxyphenylacrylic acid* (*α-chlorocaffeic acid*),

$$C_6H_3(HO)_2\cdot CH{:}CCl\cdot CO_2H,$$

have been obtained.

In view of this behaviour of piperonylacrylic acid, the action of phosphorus pentachloride on other unsaturated substances has been investigated under similar conditions.

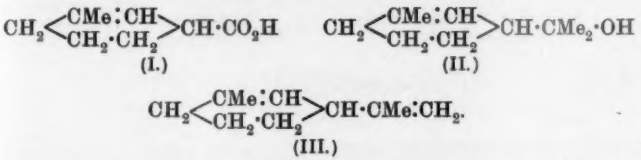
Cinnamic acid was found to yield *αβ-dichloro-β-phenylpropionyl chloride*, $C_6H_5\cdot CHCl\cdot CHCl\cdot COCl$. α-Chlorocinnamic acid gave *ααβ-trichloro-β-phenylpropionyl chloride*, $C_6H_5\cdot CHCl\cdot CCl_2\cdot COCl$, from which the corresponding *acid* and *methyl* ester were obtained.

Phenylpropiolic acid gave *αβ-dichlorocinnamyl chloride*, 2 : 3-*dichloroindenone*, and 2 : 2 : 3 : 3-*tetrachlorohydrindone*.

Crotonic acid yielded *αβ-dichlorobutyryl chloride*, and cinnamaldehyde gave an *αβγγ-tetrachloro-α-phenylpropane*, different from that obtained by Charon and Dugoujon (*Compt. rend.*, 1903, **136**, 94).

111. **"Experiments on the synthesis of the terpenes. Part X (continued). Synthesis of sylvestrene (*d*-carvestrene)." (Preliminary note.) By William Henry Perkin, jun.**

In a previous communication (*Trans.*, 1907, **91**, 480) the synthesis of *dl*-1-methyl-Δ^1-*cyclo*hexene-3-carboxylic acid (I) was described, and it was shown that the ester of this acid, on treatment with magnesium methyl iodide, is converted into *dl*-dihydrocarvestrenol or Δ^1-*m*-menthenol-(8) (II). This tertiary alcohol is readily decomposed by boiling with potassium hydrogen sulphate, with elimination of water and formation of *dl*-carvestrene (III).



(I.) (II.)

(III.)

The author has now succeeded in resolving *dl*-1-methyl-Δ^1-*cyclo*hexene-3-carboxylic acid by means of brucine, and the d-*acid* thus obtained distils at 142°/20 mm. and has $[\alpha]_D$ +70°,

Ethyl d-1-*methyl*-Δ^1-cyclo*hexene*-3-*carboxylate*, which distils at 143—144°/100 mm. and has $[\alpha]_D$ + 66°, reacts readily with magnesium methyl iodide, with the formation of d-*dihydrocarvestrenol* or Δ^1-*m*-menthenol-(8), which distils at 108—111°/30 mm. and has the constitution represented by II. It is remarkable that this tertiary alcohol is optically inactive, but that it is in reality *d*-dihydrocarvestrenol is shown by the fact that, when treated with hydrochloric acid, it yields d-*carvestrene dihydrochloride*. This substance melts sharply at 72°, has $[\alpha]_D$ + 22·0°, and is identical with sylvestrene dihydrochloride, as was proved by direct comparison with a specimen of this hydrochloride, for which the author is indebted to Prof. Wallach.

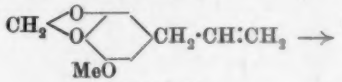
The latter melted at 72° and had $[\alpha]_D$ + 22·6°, and when mixed with the synthetical dihydrochloride there was no alteration in melting point.

Since sylvestrene dihydrochloride yields sylvestrene on treatment with aniline, the synthesis of this important terpene is complete, and these experiments prove conclusively that sylvestrene is the dextro-modification of carvestrene and has the constitution represented by the formula (III) given above.

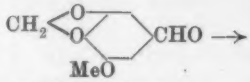
112. "Synthesis of cotarnine." (Preliminary note.)

By Arthur Henry Salway.

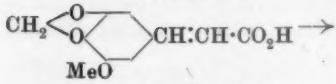
The synthesis of cotarnine has been accomplished according to the following series of reactions:



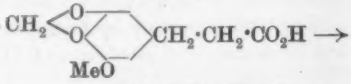
Myristicin.



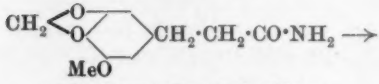
Myristicinaldehyde.



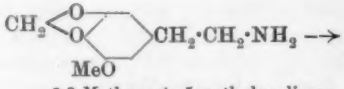
3-Methoxy-4 : 5-methylenedioxy-cinnamic acid.



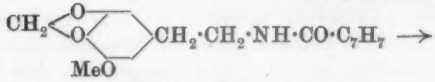
β-3-Methoxy-4 : 5-methylenedioxyphenylpropionic acid.



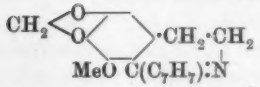
β-3-Methoxy-4 : 5-methylenedioxy-phenylpropionamide.



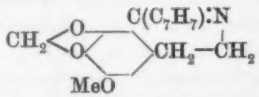
β-3-Methoxy-4 : 5-methylenedioxy-phenylethylamine.



Phenylacetyl-β-3-methoxy-4 5-methylenedioxyphenylethylamine.

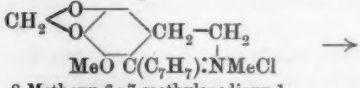


and

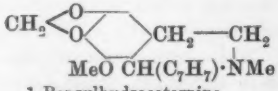


8-Methoxy-6 : 7-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline.

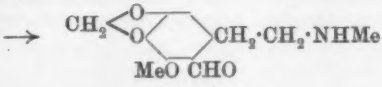
6-Methoxy-7 : 8-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline.



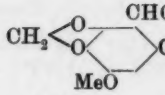
8-Methoxy-6 : 7-methylenedioxy-1-benzyl-3 : 4-dihydro*iso*quinoline methochloride.



1-Benzylhydrocotarnine.



Cotarnine.

An isomeride of cotarnine,  , has also been obtained in the above synthesis.

113. "**Note on the usually-adopted method of calculating additive physico-chemical constants.**" By **Herbert Stanley Redgrove.**

The author adduced several examples to show that, in calculating the molecular heat of combustion and the molecular heat of formation, the number and kind of affinity-bonds made and broken must be taken into account.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, *Emil.* [Editor.] **Handbuch der** biochemischen Arbeitsmethoden. Vol. I. ii., pp. xxvii + 513 to 698. ill. Wien 1910. (*Recd.* 11/3/10.)
From the Publishers: Messrs. Urban and Schwarzenberg.

American Electrochemical Society. Transactions. Vol. XVI. Philadelphia 1909. (*Reference.*) From Dr. F. Mollwo Perkin.

Barnet Book of Photography. 9th edition. pp. 316. ill. Barnet 1907. (*Recd.* 26/2/10.)
From the Publishers: Messrs. Elliott and Sons.

Boerhaave, *Hermann.* A new method of chemistry. 2nd edition. Translated by *Peter* **Shaw.** [Vol. I.] pp. xxx + 594. London 1741. (*Reference.*) From the Pharmaceutical Society.

Duparc, *Louis,* and **Basadonna,** *Mario.* Manuel théorique et pratique d'analyse volumétrique. pp. iv + 170. ill. Genève 1910. (*Recd.* 28/2/10.) From the Authors.

Institute of Metals. Journal. Vol. II. 1909. Edited by *G. Shaw* **Scott.** pp. viii + 342. ill. London 1909. (*Reference.*)
From the Institute.

Royal Medical and Chirurgical Society. The climates and baths of Great Britain. Vol. II. pp. xvi + 628. Maps. London 1902. (*Recd.* 10/3/10.) From the Society.

Thomson, *Thomas.* A system of chemistry. 5th edition. 4 vols. pp. xii + 567 [wanting v—viii], viii + 700, vii + 618, viii + 684. London 1817. (*Recd.* 11/3/10.) From the Pharmaceutical Society.

Tutton, *Alfred Edwin Howard.* Crystalline structure and chemical constitution. pp. viii + 204. ill. London 1910. (*Recd.* 19/2/10.)
From the Author.

II. *By Purchase.*

Lunge, *George.* Coal-tar and ammonia. 4th edition. 2 vols. pp. xix + 563, xiii + 564 to 1178. ill. London 1909. (*Recd.* 22/2/10.)

Orthey, *Max.* Die Metallhüttenchemie. pp. xiv + 532. ill. Leipzig 1910. (*Recd.* 8/3/10.)

III. *The under-mentioned Pamphlets have been presented to the Library by Professor Körner.*

Körner, *William.* Sulla costituzione dell' acido veratrico e del veratrol. (From the *Rend. R. Ist. Lombardo,* 1876, [2], **9.**)

—— Intorno ad alcuni prodotti di trasformazione della chinolina. (From the *Rend. R. Ist. Lombardo,* 1881, [2], **14.**)

—— Intorno all' acido caffeico ottenuto dalla *Cincona Cuprea.* (From the *Rend. R. Ist. Lombardo,* 1882, [2], **15.**)

—— Richerche sulla composizione e costitutuzione della siringina, un glicoside della *Syringa Vulgaris.* (From the *Rend. R. Ist. Lombardo,* 1888, [2], **21.**)

Körner, *William,* and **Bertoni,** *Giacomo.* Sintesi di due nuovi acidi isomeri al vanillico. (From the *Rend. R. Ist. Lombardo,* 1884, [2], **13.**)

Körner, *William,* and **Böhringer,** *Christian.* Intorno agli alcaloidi della corteccia di angustura. (From the *Rend. R. Ist. Lombardo,* 1883, [2], **16.**)

Körner, *William,* and **Contardi,** *Angelo.* Alcuni derivati nitro-alogenati della benzina, dell' anilina e dell' acetanilide. (From the *Annuario Soc. Chim. Milano,* 1908, **14.**)

Körner, *William,* and **Menozzi,** *Angelo.* Trasformazione dell' acido aspartico in acido fumarico. (From the *Rend. R. Ist. Lombardo,* 1880, [2], **13.**)

—— —— Eliminazione dell' azoto dalla tirosina. (From the *Rend. R. Ist. Lombardo,* 1881, [2], **14.**)

—— —— Intorno all' azione de jodure metilico sulla leucina ed altre sostanze analoghe. (From the *Rend. R. Ist. Lombardo,* 1883, [2], **16.**)

—— —— Intorno ad un nuovo acido isomero all' aspartico. (From the *Rend. R. Ist. Lombardo,* 1885, [2], **19.**)

—— —— Trasformazione degli acidi fumarico e maleico in acido aspartico e in asparagina. (From the *Rend. R. Ist. Lombardo,* 1887, [2], **20.**)

Körner, *William,* and **Wender,** *V.* Intorno ad alcuni nuovi derivati di sostituzione della benzina. (From the *Rend. R. Ist. Lombardo,* 1886, [2], **19.**)

Zanoni, *G.* Sintesi della β-metilpiridina (β-picolina). (From the *Rend. R. Ist. Lombardo*, 1881, [2], **14**.)

Together with 16 reprints of papers published in journals already in the Library.

BANQUET TO PAST PRESIDENTS.

The Banquet will be held at the Savoy Hotel (Embankment Entrance) on Thursday, May 26th, 1910, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887,
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, May 20th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday**, May **5th**, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The correlation of rock and river-water analyses." By H. S. Shelton.

"The composition and synthesis of caoutchouc." By S. S. Pickles.

"The constituents of the flowers of *Trifolium incarnatum*." By H. Rogerson.

"The absorption spectra of nicotine, conine, and quinoline as vapours, liquids, and in solution." By J. E. Purvis.

"Fluorones." By F. G. Pope and H. Howard.

"The triazo-group. Part XIII. Triazomethylcarbimide (triazomethyl*iso*cyanate)." By M. O. Forster and R. Müller.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 5th, 1910.

Bethwaite, John,

48, Northumberland Street, Workington, Cumberland.

Analytical Chemist. Chief Chemist and Manager for Messrs. Hardy, Dougall & Co., Analysts, Maryport, London, Cardiff, and Duisburg (Germany). Studied at the Cumberland County Council Science School, Workington. Trained in the Laboratory of the West Cumberland Iron and Steel Co., Ltd. Afterwards Assistant Chemist at the Lowther Iron Works, Workington; and Chief Assistant, Messrs. Hardy, Dougall & Co.

Pattinson B. Melmore. H. E. Wright.
J. J. Morgan. *J. M. Davey.*
Robert Hellon.

Bourdillon, Robert Benedict,

Buddington, Midhurst, Sussex.

Student of Chemistry. Have studied Chemistry at the Universities of Freiburg i.B. and Oxford during the last two years.

Harold Hartley. N. V. Sidgwick.
N. Garrod Thomas. H. B. Baker.
D. H. Nagel.

Brady, Oscar Lisle,

51, Upper Bedford Place, London, W.C.

Student. Bachelor of Arts (Honours Chemistry) University of the Cape of Good Hope. For a short time lecturer in Chemistry at Grey University College, Bloemfontein. At present research student in Organic Chemistry at University College, London.

William Ramsay. Samuel Smiles.
J. Norman Collie. Percy May.
H. Thacher Clarke.

Buswell, Henry Leslie Farmer,
169, Queen's Gate, S.W.

Analytical Chemist. Bachelor of Arts, Cambridge Science Tripos. "Chloroform Apnœa and its Causes," in conjunction with Dr. Collingwood, M.D., etc.

Thos. Farries.	*Francis H. Carr.*
Reginald G. Halstead.	*Frank L. Pyman.*
J. B. Knight.	*F. G. P. Remfry.*

Cheetham, Thomas Patrick,
Vrijheid, Natal, S.A.

Teacher, Trained Cert., Bd. Edn., Eng.; Cert., First Class, Natal Ed. Dept. Undergraduate, London and "Cape" Universities. Student and Teacher in Science for past ten years (Chemistry, Physics, Biology, Geology, Astronomy). Lond. Matric. Chemistry, '03. Read Lond. Inter. Sci., '03–04. Teachers' Course Chemistry, '05–06. L.C.C. Class, King's College, London. Orgnsg. Tr. Cl. Science in Lond., '06. Prep. Candidates for Teachers' Govt. Science, 3rd Grade, Natal Examn., 1907. Lecturer in Chemistry, Govt. Technical Classes, Durban Tech. Inst., 1907. In charge of Matric. Class and All Science Teaching, Govt. Sch., Vrijheid, 1908 to present time. Hon. Meteorological Observer to Govt. Observatory, Durban; at Vrijheid at present; and have given popular Chemical Lectures in Durban and Vrijheid.

Thos. William Dukes.	J. S. Jamieson.
E. Nevill.	*A. M. Neilson.*

A. B. Tonkin.

Clarke, Herbert Edmund,
20, Grosvenor Road, Jesmond, Newcastle-on-Tyne.

Chemist to Messrs. Cookson & Co., Ltd., Wellington Quay-on-Tyne. Second Class in Honours, School of Natural Sci., Oxford, 1907. Research B.Sc. degree, Oxford, 1909. Joint author with Mr. D. L. Chapman, M.A., of "The Measurement of a Homogeneous Chemical Change in a Gas" (*J.C.S.*, Trans., 1908, p. 1638). Chemist at Messrs. Cookson's Lead Works, Hay Hole, Wellington Quay-on-Tyne, 1909.

H. Brereton Baker.	A. F. Walden.
W. W. Fisher.	J. E. Marsh.
N. V. Sidgwick.	D. L. Chapman.

Dickson, Thomas William,
153, Finborough Road, South Kensington, S.W.

Assistant in Mathematical and Mechanical Department, City and

Guilds Central Technical College, London. Second Class Honours in Chemistry, Oxford. Mathematical and Science Master at Bilton Grange School, Harrogate, for one year. Assistant to F. W. Toms, Esq., Official Analyst for Jersey, for six months.

J. E. Marsh. John Watts.
F. W. Toms. T. V. Barker.
R. de J. Fleming Struthers. Andrea Angel.
H. R. Le Sueur.

Farrands, Harry,

The College, Isleworth.

Lecturer in Chemistry. Master of Arts, Oxford University. Second Class Honours degree in Natural Science (Chemistry), '05. Lecturer in Chemistry, Borough Road Training College, Isleworth, to students reading for London University B.Sc. degrees, 1905–1910.

H. E. W. Phillips. Henry J. S. Sand.
R. M. Caven. F. S. Kipping.
Andrea Angel.

Garland, Charles Samuel,

18, Derwent Grove, Dulwich, S.E.

Associate in Chemistry of the Royal College of Science ; at present engaged as Assistant Demonstrator.

T. E. Thorpe. G. T. Morgan.
M. O. Forster. A. Clayton.
James C. Philip. W. Godden.

Goldsbrough, Harold Albert,

Churchside, Herne Hill, London, S.E.

Analytical Chemist. Assistant to Dr. Philip Schidiowitz, F.C.S., of 57, Chancery Lane, W.C. Student of Chemistry under A. C. Chapman, Esq., F.I.C., F.C.S., and for two years at Finsbury Technical College. Holder of that College's City and Guilds Institute Certificate. Associate of the Institute of Chemistry. Co-author with Dr. Philip Schidrowitz of "The Viscosity of Indiarubber and Indiarubber Solutions," in *Journal of Society of Chemical Industry*, Jan. 15th, 1909.

Philip Schidrowitz. George T. Holloway.
R. Meldola. Alf. Chaston Chapman.
F. Henry Streatfeild.

Harrison, Edwin,

18, Old Swan Lane, Upper Thames Street, London, E.C.

Manufacturing Chemist. Am desirous of being in touch with current scientific literature.

J. H. B. Wigginton. John C. Umney.
W. Carter White. C. T. Bennett.
Ernest J. Parry.

Jones, William Jacob,

Queen's Terrace, Llanrwst.

Research Student. Fellow of the University of Wales. B.Sc. (Wales) 1908, 1st Class Honours in Chemistry. Joint author of papers: (1) "A Crystalline Bleaching Powder," (2) "The Chlorination of Acetanilide," (3) "The Primary Interaction between Chlorine and Anilides," all published in *Trans.*, Vol. **95**; also (4) "The Estimation of the Alkalinity of Bleaching Powder," *Analyst*, 1909.

Kennedy J. P. Orton. J. J. Sudborough.
H. O. Jones. *Claude M. Thompson.*
J. E. Coates.

Kenner, James,

61, Marlborough Road, Sheffield.

Research Assistant and Demonstrator in Chemistry in the University of Sheffield. Ph.D. (Heidelberg); B.Sc. (London). Joint author with Dr. Hewitt and Mr. Silk of a paper on "The Bromination of Phenols," and with Prof. Knoevenagel of a paper "Zur Darstellung der Sulfinsäuren."

W. Palmer Wynne. J. T. Hewitt.
W. E. S. Turner. Clarence Smith.
F. G. Pope.

Kwoh, Sea-Kwain,

125, Acomb Street, Manchester.

Student. Research Student. Associate of Municipal School of Technology. Hold Certificate of Victoria University in Technological Chemistry.

Jas. Grant. F. S. Sinnatt.
S. J. Peachey. E. L. Rhead.
L. G. Radcliffe. *F. G. Richards.*

Lamb, Samuel,

May Villa, Birmingham Road, West Bromwich.

Chemist (Messrs. Chance's Glass and Lighthouse Construction Works). 1st Associate of Royal School of Mines. Honoursman in Chemistry (org. and inorg.—theo. and prac.), Board of Education. National Scholar in Chemistry, 1905.

S. Herbert Cox. F. W. Harbord.
W. Gowland. W. H. Merrett.
E. O. Courtman.

Lewis, Frederick Charles,

20, Eskburn Road, Liverpool.

Assistant Director Clinical Research Department, University of Liverpool. Assistant to Sir R. Boyce, F.R.S., one of the Public

Analysts, and Bacteriologist to City of Liverpool, etc. Has had extensive experience in Consulting Bacteriology; also Pathology and Physio-Chemistry, including investigation and analysis. Has conducted researches into: 1. Cause and Prevention of "Ropiness" in Bread. 2. Cause of Deterioration and Liquefaction of certain Commercial Products (Joint). 3. Chemistry and Pathology of Degenerating Fibromyomata (Joint). 4. Chemistry of certain Organic Solutions Artificially Infected with Specific Bacteria.

Gilbert J. Fowler. *Alfred Smetham.*
John Hanley. *Prosper H. Marsden.*
James Ed. Southcombe. *William Ramsay.*
Bernard Dyer.

Lucking, Hubert Leslie,

St. Mary's, West Heath Road, Hampstead, N.W.

Research Student. Ph.D. (Heidelberg). Studying Chemistry. Worked for a year under Graebe at Geneva, and four and a-half years under Curtius at Heidelberg. Doctor Dissertation "Ein Beitrag Zur Kenntnis der Hydrazinate."

Thomas Callan. Arthur W. Crossley.
H. Jermain Creighton. *M. O. Forster.*
Alexander Scott.

Longman, Charles Herbert Bell,

32, Faringdon Street, Swindon, Wilts.

Lecturer in Chemistry, Tientsin Anglo-Chinese College, Tientsin, China. Student at the Royal College of Science, London, 1906–09, and obtained the Associateship of the Royal College of Science in Chemistry, 1909. Student at the Swindon Technical Institution Science Classes, 1903–06. Intermediate B.Sc. (London) 1905 in Chemistry, Physics and Mathematics. In conjunction with the Vice-Principal of the Tientsin Anglo-China College (J. B. Tayler, Esq., M.Sc., Victoria University, England, Member of the Society of Chemical Industry), we hope to take up research, more especially devoting our attention to native products, and desire to keep in touch with the work of investigators in other parts of the world.

Thomas Hartley. G. T. Morgan.
Thomas C. Davison. M. O. Forster.
James C. Philip.

Mason, Horace George,

The Grammar School, Kingsbridge, S. Devon.

Science Master at above School. Graduate (B.Sc. Hons. in Chemistry) of Manchester University. Have participated in research work,

and desire to take the journals with a view to doing more research work, and also to keep in touch with the latest developments of chemistry.

W. H. Perkin. H. C. H. Carpenter.
Ch. Weizmann. V. J. Harding.
H. F. Coward. A. N. Meldrum.

Needs, Francis Edwin,

7, Effingham Road, St. Andrew's Park, Bristol.

Chemical and Bacteriological Assistant in the State Medicine Laboratory, Bristol (1906–1910). Ex-Student in Chemical Department, Merchant Venturers' Technical College (1901). Late Assistant in the Wilts County Laboratory (1902–1906).

Edward Russell. Chas. J. Waterfall.
Fredk. O'Brien. F. Wallis Stoddart.
J. Wertheimer.

Knowles, Preston.

Newhaven, Camden Avenue, Feltham, Middlesex.

Analytical Chemist. Four years as Pupil with Public Analyst of Bolton; also Student of Electro-metallurgy at Municipal School of Technology, Manchester. Seven years' experience as Chemist—five years as Chief Chemist—in Electro-chemical Works.

Walter Ratcliffe. A. W. Cowburn.
J. Harold Edge. *James Porter Shenton.*
John E. Farmer.

The following Certificates have been authorised for presentation to Ballot by the Council, under Bye-law I (3):

Baume, Georges,

44, Quai des Eaux, Vives, Genève.

Privat-docent à l'Université, 1er Assistant aux Laboratoires de Chimie Théorique et Technique de l'Université. Densité des gaz SO_2,$(CH_3)_2O$,CH_3Cl,CH_4,C_2H_6,H_2S. Compressibilité de quelques gaz aux basses pressions. Principe de 2 méthodes de détermination physico-chimiques du froids moléculaire de gaz. Constants physicochimiques de quelques gaz liquéfiés. Courbes de fusibilité des mélanges gazeux aux basses températures. Publiés en grande partie *J. Ch. phys.*

H. Le Chatelier. T. P. Hilditch.
William Ramsay.

Cardoso, Ettore,

Geneva, 3 Grand' Rue.

Assistant particulier au Laboratoire de Chimie-Physique (Directeur: Prof. Ph. A. Guye). Docteur-és-sciences (Grenoble). (1) Have published the following: "Recherches sur les compressibilités et les tensions de vapeur des mélanges d'oxyde de méthyle et d'acide sulfureux: formation d'une combinaison entre ces deux corps (*C.R.*, 1907, **144**, 911; with Dr. Briner); (2) Sur la liquéfaction et la compressibilité des mélanges gazeux; étude particuliére du cas où le mélange donne lieu à une combinaison" (*J. Ch. Phys.*, 1908, **6**, 641; with Dr. Briner); (3) "Densités orthobares de l'anhydride sulfureux" (*Arch. Sc. Phys. Nat. Gen.*, **28**, 392).

W. Spring. T. P. Hilditch.

William Ramsay.

Shah, Motilal Kashalchand,

Byculla Bridge, Byculla, Bombay, India.

Chemist and Manager, the Gujarat Candle Factory and Asbestos Works Company, Limited, Bombay, India. A detailed statement of Study, Service, Contribution to Science, Practice and Research, List of Awards and Testimonials, with extracts of opinions attached herewith.

Ruchi Ram Sahni.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 14/5/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 371.

Thursday, May 5th, 1910, at 8.30 p.m., Professor Harold B. Dixon, M.A., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs. :

Middleton Henry Dand, Steyning, Sussex.
John Edward Hackford, B.Sc., 15, Burford Road, Nottingham.
Govind Laxman Joshi, 5, Argyle Avenue, Victoria Park, Manchester.
Frank Stevenson Long, B.Sc., 80, Tylney Road, Forest Gate, E.
Walter William Reed, M.Sc., 28, South Parade, Huddersfield.
John George Rose, Government Analytical Laboratory, Cape Town.
St. Clair Overbeck Sinclair, M.A., Government Analytical Laboratory, Grahamstown, Cape Colony.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

Georges Baume.
John Bethwaite.
Robert Benedict Bourdillon.
Oscar Lisle Brady, B.A.
Henry Leslie Farmer Buswell, B.A.
Ettore Cardoso, D.Sc.
Thomas Patrick Cheetham.
Herbert Edmund Clarke, B.Sc.
Thomas William Dickson, B.A.
Harry Farrands, M.A.
Charles Samuel Garland.
Harold Albert Goldsbrough.
Edwin Harrison.
William Jacob Jones, B.Sc.
James Kenner, Ph.D., B.Sc.
Sea-Kwain Kwoh.
Samuel Lamb.
Frederick Charles Lewis.
Charles Herbert Bell Longman.
Hubert Leslie Lucking, Ph.D.
Horace George Mason, B.Sc.
Francis Edwin Needs.
Knowles Preston.
Motilal Kashalchand Shah.

Of the following papers, those marked * were read :

***114. "The correlation of rock and river-water analyses." By Henry Stanley Shelton.**

The author called attention to the necessity of correlation between the analyses of rocks and of river-waters. Further remarks were added to what has already been published concerning the amount of sodium. Attention was also called to the large amount of sulphates shown in river-water analyses, and to the discrepancy between these analyses and those of the rocks which show a very minute proportion of sulphur. Some suggestions were made to analysts with the view of explaining the discrepancy and of correlating these two departments of chemical work.

Discussion.

Dr. Dyer observed that river-water was largely drawn from surface drainage, and that surface soil necessarily contained sulphates, for sulphur was an integral constituent of the proteins in plants. The decay of plant residues in the soil and the consumption of crops by animals on the land must constantly produce sulphates. Farmyard manure contained plenty of sulphates.

Mr. J. Phelps suggested that the large proportion of sulphur in river-water, compared with that in igneous and sedimentary rocks, might be due to the fact that water flows through the rocks chiefly along "faults," in which mineral veins, containing a much larger proportion of sulphur than the bulk of the rock, are frequently found; and that river beds usually followed such geological formations.

Mr. Shelton said that vegetation undoubtedly segregated some portion of sulphate, but it could not be regarded as an original source. Mr. Phelps's argument rather increased the difficulty than solved it, for it would imply that, in continents which had been upheaved for prolonged geological eras, no sulphide would remain. In reply to Mr. Baly, he remarked that organo-silicic acid would decompose into organic matter and silica. The circulation of organic matter he had not considered in detail. There were many ways in which an excess of oceanic carbonaceous matter could be returned to the land. Silica was undoubtedly deposited in large quantities over the greater part of the ocean floor. Dr. Colman's reference to the incrustation caused in boilers in which river-water had been used was a question that could only be settled by further investigation. It was not disputed that river-waters contained some sulphate. What proportion would account for boiler incrustation could not be determined without careful quantitative analysis.

*115. "The constitution and synthesis of caoutchouc." By Samuel Shrowder Pickles.

In statements made recently by Klages and by Harries (*Chem. Zeit.*, 1910, **36**, 315), certain doubts have been expressed regarding the possibility of the polymerisation of isoprene into caoutchouc by the methods indicated by Tilden. These methods were of two characters, (1) the action of certain reagents (for example, an aqueous solution of hydrogen chloride) on isoprene, and (2) the slow spontaneous polymerisation of isoprene itself.

The latter method has been repeated by the author, and a white, rubber-like compound was produced, which gave derivatives like those obtained from natural caoutchouc, namely, the tetrabromide, $(C_{10}H_{16}Br_4)_x$, and the nitrosite.

The constitution of caoutchouc was discussed, objection being taken to the dimethyl*cyclo*octadiene formula. Other formulæ were proposed for caoutchouc and the ozonide which, the author considered, afford a better explanation of the properties and behaviour of these substances.

Discussion.

The President inquired whether the author had studied the ethyl analogue of isoprene.

Dr. Stevens inquired whether the author had extracted the substance obtained with acetone. This solvent would probably dissolve out most of the impurities, leaving the caoutchouc intact. He also drew attention to a statement made by Harries, namely, that *cyclo*-octadiene readily polymerises when warmed, to yield a caoutchouc-like substance. In all probability a series of derivatives existed, and this would explain the fact he (Dr. Stevens) had observed that the caoutchouc obtained from different latex-bearing trees varied in physical and chemical properties, however carefully it might be purified.

Dr. Pickles, in reply to the President, stated that, of the so-called derivatives of isoprene, one had been observed to have similar properties. Kondakoff had shown that methylisoprene ($\beta\gamma$-dimethyl-$\Delta^{\alpha\gamma}$-butadiene) underwent polymerisation to a rubber-like compound in a few months time. He (the speaker) had himself tried the experiment with dimethylisoprene ($\beta\delta$-dimethyl-$\Delta^{\beta\delta}$-pentadiene), but this did not appear to polymerise readily. The displacement of the hydrogen atoms attached to the terminal carbon atoms of isoprene by methyl groups apparently prevented or restrained polymerisation.

In reply to Dr. Stevens, Dr. Pickles said that the polymeride of isoprene, as at first precipitated, was more or less sticky. This was

probably due, not to resin, but to the presence of hydrocarbons other than rubber. Natural rubber was similarly sticky and weak when first precipitated from solution in terpenes. Although Harries had obtained a rubber-like compound from the polymerisation of octadienes, he had not shown that it formed additive compounds of the type $C_{10}H_{16}Br_4$. Ethyl acrylate readily polymerised to rubber-like compounds, but in the process the double bond disappeared.

Replying to Dr. Forster, Dr. Pickles was of the opinion that, granting the possibility of residual affinities causing a kind of polymerisation in an unsaturated compound, those residual affinities should disappear when the compound became saturated, and therefore the bromide $C_{10}H_{16}Br_4$ should be a simple chemical molecule.

***116. "The constituents of the flowers of trifolium incarnatum." By Harold Rogerson.**

The dried flowering tops of the carnation clover (*Trifolium incarnatum*, Linné), when extracted with alcohol and the resulting extract distilled in a current of steam, yielded a small amount of an essential oil, which contained furfuraldehyde, and possessed the following constants: d 20°/20° = 0·9597; α_D − 1°48′ in a 1-dcm. tube.

The portion of the alcoholic extract which was soluble in water contained a quantity of a sugar which yielded *d*-phenylglucosazone (m. p. 205—206°), and from the aqueous liquid the following definite substances were isolated: benzoic and salicylic acids in very small amount, with apparently a trace of *p*-coumaric acid; pratol, $C_{16}H_{12}O_4$; quercetin, $C_{15}H_{10}O_7$, and a new glucoside of the latter, $C_{21}H_{20}O_{12}$,$3H_2O$ (m. p. 242—245°), which has been designated *incarnatrin*.

The portion of the alcoholic extract which was insoluble in water consisted chiefly of resinous material, but from it the following compounds were obtained: an alcohol, $C_{34}H_{69}OH$ (m. p. 72—74°), which had previously been obtained from the wax of the humble-bee, and which it is now proposed to designate *incarnatyl alcohol*; hentriacontane, $C_{31}H_{64}$; a phytosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D$ − 41·7°); trifolianol, $C_{21}H_{34}O_2(OH)_2$ (m. p. 295—300°; $[\alpha]_D$ − 44·1°), and a mixture of fatty acids.

***117. "The triazo-group. Part XIII. Triazomethylcarbimide (triazomethyl *iso*cyanate)." By Martin Onslow Forster and Robert Müller.**

Triazomethylcarbimide, $N_3{\cdot}CH_2{\cdot}N{:}C{:}O$, prepared by heating the triazoacetyl azide which arises from interaction of triazoacetyl chloride

and sodium azide, boils at 44—45°/32 mm., and has sp. gr. 1·258/18°; it changes rapidly when heated into *tristriazomethyl* isocyanurate, $(N_3 \cdot CH_2 \cdot NCO)_3$, which melts at 153°. *Phenyltriazomethylcarbamide*, $C_6H_5 \cdot NH \cdot CO \cdot NH \cdot CH_2 \cdot N_3$, and *triazomethylcarbamide*,

$$N_3 \cdot CH_2 \cdot NH \cdot CO \cdot NH_2,$$

melt at 120° and 56° respectively.

In all these compounds the union between carbon and the triazo-group is so weakened by association with another atom of nitrogen that hydrazoic acid may be eliminated from them by the action of water.

118. "The absorption spectra of nicotine, coniine, and quinoline as vapours, liquids, and in solution." By John Edward Purvis.

The general results of an examination of the absorption spectra of nicotine, coniine, and quinoline are: (1) *N*/1000-alcoholic solution of nicotine exhibited an absorption band in the ultra-violet, showing its relationship to pyridine; the vapour of nicotine showed none of the series of narrow bands found by the author in pyridine; and liquid nicotine, like that of pyridine, showed no selective absorption.

(2) *N*/10-, *N*/100-, and *N*/1000-alcoholic solutions of coniine showed no bands of selective absorption in the ultra-violet, a result similar to that noticed by Hartley in solutions of piperidine; the vapour of coniine showed none of the series of bands found in the vapour of piperidine; and liquid coniine, like liquid piperidine, was remarkably transparent.

(3) *N*/1000-alcoholic solutions of quinoline exhibited three bands in the ultra-violet, as observed by Hartley; the vapour of quinoline had no narrow bands analogous to those found in benzene by Hartley, or to those in pyridine found by the author; and liquid quinoline showed no bands of selective absorption.

The results were compared with the previous results of the examination of the spectra of pyridine and its derivatives, and were discussed from a consideration of the constraint on the pulsations of the nucleus influenced by the side-chains and by their freedom of movement when existing as vapours, liquids, or in solution.

119. "Fluorones." By Frank George Pope and Hubert Howard.

Fluorone derivatives may be obtained by the oxidation of hydroxyphenylxanthen derivatives in alkaline solution in a current of air. The betaine ortho-quinonoid structure of Kehrmann was rejected, since phenylmethylfluorone is quite insoluble in alkali, and the opinion was expressed that Doebner's resorcinolbenzein is identical with hydroxyphenylfluorone, as was first pointed out by Kehrmann in 1908.

120. "Ionic equilibrium in solutions of electrolytes." By James Riddick Partington.

The dilution law for solutions of strong electrolytes referred to in a preliminary note (*Proc.*, 1910, **26**, No. 365, 8) was considered in relation to the fundamental hypothesis of the ionising effect of moving ions, and a possible method of testing this hypothesis experimentally was suggested. The formula was contrasted with others previously obtained, and was shown to be applicable to the existing data for twelve typical binary electrolytes.

121. "Sodium succinates." By Hugh Marshall and David Bain.

An examination of the sodium succinates and of the equilibrium-relationships in the system $Na_2C_4H_4O_4 : H_2C_4H_4O_4 : H_2O$ has been made in continuation of the work done on the potassium salts by Marshall and Cameron (*Trans.*, 1907, **91**, 1519). The only salts obtained were : $NaHC_4H_4O_4,3H_2O$; $NaHC_4H_4O_4$; $Na_2C_4H_4O_4,6H_2O$; $Na_2C_4H_4O_4,H_2O$. With the exception of the last-mentioned, all of these had already been described. A solubility diagram has been made for the system, with isotherms for 0°, 25°, 50°, and 75°. Although no superacid salt was isolated corresponding with the potassium salt, $KH_3(C_4H_4O_4)_2$, the results seem to indicate the formation of some such salt in solution, since the quantity of extra succinic acid which passes into solution on the addition of a given quantity of sodium succinate is, at higher temperatures, considerably more than can be explained by the formation of the ordinary acid salt. (The addition of the acid salt itself increases the solubility of succinic acid.)

The transition points for the hydrated salts were determined dilatometrically, and solubility curves (0—75°) for the normal salt, the acid salt, and the acid itself have been drawn.

122. "The formation and reactions of imino-compounds." Part XII. The formation of imino-derivatives of *cyclo*pentane from open-chain mononitriles." By Alec Duncan Mitchell and Jocelyn Field Thorpe.

The authors showed that the formation of the five-carbon ring through the imino-group is not confined to open-chain dinitriles, but that mononitriles having a carbethoxyl group in the δ-position with respect to the nitrile group also pass readily into imino-derivatives of *cyclo*pentane. Thus *ethyl* 2-*imino*cyclo*pentane*-1 : 3-*dicarb-*

oxylate (I) is formed by the condensation of ethyl sodiomalonate (II) and ethyl 1-cyano*cyclo*propane-1-carboxylate (III), ethyl carbonate being formed at the same time :

$$\begin{matrix}CH_2\\CH_2\end{matrix}\!>\!C(CN)\cdot CO_2Et + CHNa(CO_2Et)_2 \longrightarrow$$

(III.) (II.)

$$\begin{matrix}CH_2\cdot CH(CO_2Et)\\CH_2\cdot CH(CO_2Et)\end{matrix}\!>\!C{:}NH + CO(OEt)_2.$$

(I.)

Ethyl 2-imino*cyclo*pentane-1 : 3-dicarboxylate is at once hydrolysed by hydrochloric acid, yielding *ethyl* cyclo*pentan*-1-*one*-2 : 5-*dicarboxylate* (IV), from which either *cyclo*pentane (V) can be produced by acid hydrolysis, or adipic acid (VI) by the action of alkalis :

$$\begin{matrix}CH_2\cdot CH(CO_2Et)\\CH_2\cdot CH(CO_2Et)\end{matrix}\!>\!CO \qquad \begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\!>\!CO \qquad \begin{matrix}CH_2\cdot CH_2\cdot CO_2H\\CH_2\cdot CH_2\cdot CO_2H\end{matrix}$$

(IV.) (V.) (VI.)

123. "New sensitive test for hydrocyanic acid." By James Moir.

The author having found the guaiacum test unsatisfactory, and the phenolphthalin-copper test sometimes inapplicable, has succeeded in finding a reagent which will detect hydrocyanic acid in a dilution approaching one part in five millions of water.

The test depends on the oxidation of a leuco-compound by nascent cyanogen resulting from the action of cupric copper on cyanides, but the author finds that none of the common leuco-compounds can be used.

The reagent is made by adding small quantities of copper acetate and acetic acid to a warm solution of hydrocœrulignone (tetramethoxy-diphenol) in a large quantity of water, digesting the mixture at 50° for a few hours, and filtering. The solution to be tested is rendered faintly acid with acetic acid (using sodium acetate also if a "strong" acid is present), and then treated with about one-quarter of its volume of the reagent.

In solutions stronger than 1 in 100,000, an immediate crystalline precipitate of cœrulignone (red with purple lustre) is obtained; with weaker solutions, a brick-red coloration. Oxidising substances must, of course, be absent, but most of them can be avoided by applying the test on paper exposed to the vapour evolved by the liquid to be tested, as in the guaiacum test.

A similar reaction is given by other tetra-substituted diphenols and by benzidine and its derivatives. Benzidine gives an indigo shade; dianisidine, bluish-green, and tolidine, a green shade.

Although not so sensitive as hydrocœrulignone, these reagents are more trustworthy and keep much better. The colours produced are all derivatives of so-called diphenoquinhydrone.

124. "Changes in volume in the formation of dilute solutions." By Harry Medforth Dawson.

The changes of volume which occur in the formation of dilute solutions of iodine and naphthalene have been determined for fifteen different solvents at 18°. For these solvents the "solution volume" of one gram-molecule of iodine varies from 67·2 to 50·5 c.c.; that of one gram-molecule of naphthalene from 125·5 to 112·9 c.c. If the solvents are arranged according to the magnitude of the observed volume change, an entirely different sequence is obtained according to whether the dissolved substance is iodine or naphthalene. There appears to be no connexion between the internal pressure of the solvent and the "molecular solution volume" of the solute in the case of either of the dissolved substances, and the observed changes in volume cannot be interpreted in terms of the change in internal pressure which follows from the addition of the solute to the solvent. To explain the observations it seems necessary to admit that in many cases combination occurs between solvent and solute.

125. "Deninger's carbon monosulphide." By Frederick Percy Dunn.

In 1895 Deninger (*J. pr. Chem.*, [ii], **51**, 346) described the preparation of a gas obtained by the action of iodoform on silver sulphide, which he assumed to be the missing carbon monosulphide. Subsequent investigation has not confirmed his supposition. Russell and Smith (*Trans.*, 1902, **81**, 1538) studied Deninger's reaction, and obtained a reddish-yellow liquid having the characteristic odour of the alkyl sulphides, but failed to find any evidence of the existence of carbon monosulphide. At the same time their experiments gave no very precise indication as to what was the exact nature of the action of iodoform on silver sulphide.

From a preliminary study of the mutual behaviour of the two substances, it appeared not unlikely that the course of the reaction was really due to the decomposition of the iodoform by heat, and that the products of this change mutually reacted or were acted on by the silver sulphide.

The decomposition of iodoform was first studied by Hofmann (*Quart. Journ. Chem. Soc.*, 1861, **13**, 65), who found that on heating

it for some hours in a sealed tube at 150°, and then distilling the product in a current of steam, methylene iodide was obtained, together with a brown residue, "the nature of which appeared anything but attractive." It was subsequently shown by Schmidt (*Arch. internat. Pharm. Therap.*, 1901, **8**, 110) that even at the temperature of boiling water, iodoform in the presence of air evolves iodine with the simultaneous formation of the two oxides of carbon.

By heating iodoform in a vacuous tube at 180° (the temperature at which Deninger heated his materials), it was found to be resolved into iodine, methylene iodide, carbon, a trace of hydrogen iodide, a very small quantity of a hydrocarbon, probably methane, as shown by the explosion results, and possibly traces of free hydrogen. Some portion of the methylene iodide was doubtless obtained by the action of hydrogen iodide on iodoform (Lieben, *Zeitsch. Chem.*, 1868, **4**, 712). By heating either iodoform or methylene iodide with silver sulphide, the reddish-yellow liquid described by Russell and Smith was obtained.

The course of Deninger's reaction appears to be mainly as follows: methylene iodide, formed by the decomposition by heat of the iodoform, acts on the silver sulphide with the formation of methylene sulphide, probably a lower polymeride of the compound obtained by Husemann (*Annalen*, 1863, **126**, 294) by the action of alcoholic sodium sulphide on methylene iodide.

Russell and Smith (*loc. cit.*) state with regard to the gas obtained from their experiment that "on explosion with oxygen about 6 per cent. of sulphur dioxide was formed, accompanied by more than five times that amount of carbon dioxide; this result is completely explained by the presence of the vapours of carbon disulphide and the reddish-yellow sulphide, and indicates that in the latter compound there are four or more carbon atoms to each atom of sulphur." This conclusion appears to be erroneous, since, as the silver sulphide and iodoform were heated in the presence of air, carbon dioxide and monoxide would be obtained (Schmidt, *loc. cit.*), together with a small quantity of a hydrocarbon, the presence of which was proved in the present experiments. Hence a certain proportion of the carbon dioxide obtained would be due to this circumstance.

The reaction between bromoform and silver sulphide was also studied, the products of the reaction being silver bromide, hydrogen sulphide, carbon, a small quantity of a solid alkyl sulphide, and a trace of free sulphur. Neither in the reaction between silver sulphide and iodoform nor in that between silver sulphide and bromoform was there found any trace of the solid polymeride of carbon monosulphide recently described by Dewar and Jones (*Proc. Roy. Soc.*, 1910, **83**, *A*, 526).

126. "The resolution of externally compensated acids and bases." By William Jackson Pope and John Read.

It was shown that when the resolution of an externally compensated acid (or base) is attempted by crystallisation with an optically active base (or acid), one of three different kinds of behaviour is to be observed. (1) The two salts, *d*B*d*A and *d*B*l*A, which are capable of formation, are readily separable by crystallisation, and show no tendency to form solid solutions one in the other; in this case an easy separation is effected by the method of Pope and Peachey. (2) The two salts, *d*B*d*A and *d*B*l*A, combine to form a partially racemic compound; in this case no resolution occurs. (3) The two salts, *d*B*d*A and *d*B*l*A, form solid solutions one in the other, and separation by fractional crystallisation is slow and very incomplete.

The resolution of externally compensated camphor-π-sulphonic acid by crystallisation with one-half an equivalent of strychnine, in accordance with Pope and Peachey's method, was readily effected, and forms a typical instance of behaviour of the kind (1). The resolution of 1-methyl*cyclo*hexylidene-4-acetic acid by crystallisation with brucine is very difficult to effect, owing to it presenting a case of the new type (3). The separation by crystallisation of *d*-bornylamine and *d-neo*-bornylamine *d*-a-bromocamphor-π-sulphonates and of *d*-menthylamine and *d-iso*menthylamine hydrochlorides also proved difficult, owing to the formation of solid solutions between the two component salts of the mixture.

127. "The interaction of alkyl halides and metals of the iron group." By James Frederick Spencer and Muriel Kate Harrison.

An attempt to ascertain whether metals of the sixth, seventh, and eighth groups could be caused to react with alkyl halides, after the manner of other metals (*Trans.*, 1908, **93**, 68, 1821; 1910, **97**, 385), led to the results described below, which, although in the main negative, show that there is no tendency on the part of these metals to form compounds of the type R·M″·X.

Of the metals experimented with, namely, iron, cobalt, nickel, manganese, chromium, and molybdenum, only iron and nickel reacted with alkyl halides, and these only when heated in a sealed tube for several hours.

The reaction between the metals nickel and iron and iodobenzene takes place very completely, with the formation of diphenyl in extremely large yields, and constitutes a very good method for the preparation of this substance.

Nickel which has been freshly reduced from the oxide by means of hydrogen is mixed with iodobenzene out of contact with air, and heated in a sealed tube for several hours at 280°.

After cooling, the contents of the tube are distilled in a current of steam, and 85 per cent. of the theoretical quantity of diphenyl is obtained.

In the case of iron a similar reaction occurs at 180°, and the yield of diphenyl is 65 per cent. of the theoretical.

This reaction is not general, for, with the exception of *p*-iodotoluene, it could not be brought about in the case of any other halogen derivative.

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in June next. Applications for Grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 6th, 1910.

All persons who received grants in June, 1909, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Wednesday, June 1st.

The Council wish to draw special attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

ERRATUM.

PROCEEDINGS, 1910.

Page.	Line.	
107	16	*for* "**Knowles, Preston,**" *read* "**Preston, Knowles.**"

In consequence of the death of His Majesty King Edward, the Banquet to the Past Presidents of the Society, fixed for May 26th, has been postponed.

The Ordinary Scientific Meeting of the Society fixed for Thursday, May 19th, has been postponed until Thursday, May 26th, 1910, at 8.30 p.m.

The following papers will be communicated:

"The constituents of the leaves of *Prunus serotina*." By F. B. Power and C. W. Moore.

"Mechanism of tautomeric change." By H. T. Tizard.

"A new sulphide of nitrogen." By F. P. Burt.

"Volumetric estimation of manganese in manganese ores." By H. V. Krishnayya.

"Reactions of copper." By T. N. Das.

"Synthesis of 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid." By V. J. Harding and C. Weizmann.

"Note on the paper by Dr. A. Slator and Dr. H. J. S. Sand on 'The rôle of diffusion in fermentation by yeast cells.'" By H. T. Brown.

"The resolution of gnoscopine (*dl*-narcotine). Preliminary note." By W. H. Perkin and R. Robinson.

"The action of potassium chlorate on concentrated sulphuric acid. Preliminary note." By S. Smith.

"The products of diazotisation of the trinitro-*p*-anisidines." By R. Meldola and F. Reverdin.

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Issued 10/6/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. Nos. 372 and 373.

Thursday, May 26th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. O. L. Brady, T. W. Dickson, E. Hinks, W. E. S. Turner, and J. Young were formally admitted Fellows of the Society.

The President stated that the Council, at their Meeting held that afternoon, had sealed the following respectful Address of Condolence and Congratulation for presentation to his Majesty King George V. He moved that the Fellows of the Society should join with the Council in paying respect to the memory of the late illustrious King Edward VII and in offering homage to his Majesty King George V. This motion was seconded by Mr. C. E. Groves, and carried unanimously, the Fellows present all standing.

TO HIS MOST GRACIOUS MAJESTY KING GEORGE V.

MAY IT PLEASE YOUR MAJESTY

We, the President, Council and Fellows of The Chemical Society, most respectfully beg leave to approach your Majesty with an expression of our deepest sympathy in the great loss which your Majesty and the Empire have sustained in the death of His Most Gracious Majesty our late Sovereign Lord King Edward VII.

The Chemical Society will always bear in grateful remembrance the fact that a Royal Charter was granted to us by Queen Victoria,

whose illustrious Consort took the deepest interest in the promotion of Science, and specially fostered the growth of Chemical Science in this country by the foundation of the Royal College of Chemistry.

We recall with gratitude the Royal welcome accorded last year by your Majesty, and her Majesty Queen Mary, to the Chemists of all Nations assembled in your Capital at the International Congress of Applied Chemistry.

We venture to hope that your Majesty's reign may see discoveries in Chemical Science no less brilliant and contributing no less to the welfare of your people than those which marked the reigns of your August Father and of Queen Victoria.

We beg leave to be permitted to offer to your Majesty this expression of our sincere congratulation on your accession to the Throne, and to assure your Majesty of our loyal devotion and of our earnest wish and prayer that your Majesty's reign may be long, happy and beneficent.

Signed on behalf of the Chemical Society,

	(Signed)	HAROLD DIXON,	PRESIDENT,
	„	ALEXANDER SCOTT,	TREASURER,
L. S.	„	ARTHUR W. CROSSLEY,	HONORARY SECRETARIES,
	„	G. T. MORGAN,	
	„	HORACE T. BROWN,	FOREIGN SECRETARY.

Dated this Twenty-sixth Day of May, One Thousand Nine Hundred and Ten.

The President made the following announcements:

(1) That owing to the death of his Most Gracious Majesty King Edward VII, the Banquet to Past Presidents had been postponed by the Council from May 26th to November 11th, 1910.

(2) That the following Resolution of Council had been communicated to Signor Cannizzaro, son of the late Honorary and Foreign Member, Professor Stanislao Cannizzaro:

The President, Officers, and Council of the Chemical Society have heard with deep regret of the death of Professor Stanislao Cannizzaro, the senior among their distinguished Honorary and Foreign Members.

All Chemists look back to the work of Professor Cannizzaro as one of the turning points in the progress of theoretical chemistry; and the

Fellows will ever bear in grateful memory the masterful exposition of his views given to the Society by the Faraday Lecturer of 1872.

The Council desire to express to the family of their late colleague the deepest sympathy in their loss.

(Signed) HORACE T. BROWN,
Foreign Secretary.

May 12th, 1910.

(3) That a fund was being collected to found a memorial to the late Professor Richard Abegg, the memorial to take the form of bursaries for students of Chemistry and Metallurgy at the University of Breslau.

Subscriptions to the fund would be received by the President or Sir William Ramsay.

(4) That the Council had invited Prof. Theodore W. Richards to deliver the Faraday Lecture during the next Session. The invitation had been accepted, and an announcement of the date of the Lecture would be made later.

Certificates were read for the first time in favour of Messrs.:

Ward Allen Batley, M.Sc., 197, Eccles New Road, Salford.
Ronald Leslie Collett, B.A., Little Dawley, Hayes, Middlesex.
Charles Frederick Guhlmann, Grantwood, Bergen Co., New Jersey, U.S.A.
Lionel Leslie Jacobs, Shelford, Beckenham, Kent.
William Ernest Martin, 111, Bellevue Road, Berea, Durban, Natal.
Benjamin Mason Narbeth, B.Sc., Durban Technical Institute, Durban, Natal.
Robert O'Field Oakley, 54, Sydney Road, Hornsey, N.
John Alexander Reddie, 3, Spring Gardens, Bradford, Yorks.
Ernest Stedman, B.Sc., 6, Breakwater Road, Bude, Cornwall.

Certificates of Candidates have been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of Messrs.:

Kaikhushroo Bamanji Sorabji, Secunderabad, Deccan, India.
John Williams, B.Sc., 122, Liddell Street, Invercargill, New Zealand.

Of the following papers, those marked * were read:

***128. "The constituents of the leaves of Prunus serotina." By Frederick Belding Power and Charles Watson Moore.**

The material employed, consisting of the air-dried leaves of *Prunus serotina*, Ehrhart, yielded, on maceration with water, an amount of hydrogen cyanide equivalent to 0·0086 per cent. of its weight. The leaves contain a relatively small amount of *l*-mandelonitrile glucoside, together with an enzyme which hydrolyses β-glucosides. An alcoholic extract of the leaves, on distillation in a current of steam, yielded a very small amount of an essential oil, but no hydrogen cyanide. The non-volatile constituents of the leaves consisted of a green resin, insoluble in either hot or cold water, and material which remained dissolved in the aqueous liquid. The green resin, amounting to about 5·5 per cent. of the weight of the leaves, yielded hentriacontane, pentatriacontane, ceryl alcohol, palmitic, stearic, linolic and *iso*linolenic acids, a little ipuranol, $C_{23}H_{38}O_2(OH)_2$, and a new crystalline substance, $C_{31}H_{48}O(OH)_2$, melting at 275—277°, which has been designated *prunol*. The portion of the alcoholic extract which was soluble in water contained benzoic acid, quercetin, a new glucoside of quercetin, $C_{21}H_{20}O_{12},3H_2O$ (m. p. 245°), which has been designated *serotrin*, and *l*-mandelonitrile glucoside, together with a quantity of sugar and tannin. The aqueous liquid, after heating with dilute sulphuric acid, yielded, furthermore, *l*-mandelic acid, which had evidently been formed by the hydrolysis of the *l*-mandelonitrile glucoside.

***129. "The action of potassium chlorate on concentrated sulphuric acid." (Preliminary note.) By Stanley Smith.**

The author has observed that at 338° the action of potassium chlorate on concentrated sulphuric acid is entirely unattended by explosive violence, the addition of the powdered salt to the boiling acid merely resulting in a brisk effervescence, with the production of chlorine, oxygen, and perchloric acid. The volume of oxygen evolved corresponds with about 90 per cent. of the total oxygen contained in the potassium chlorate, whilst the amount of perchloric acid formed appears to be very small.

This reaction was studied at various temperatures, and it was found that from 338° to 200° no crackling or detonation is produced. At 170°, however, the addition of potassium chlorate to sulphuric acid results in a number of small detonations, which increase in violence as the sulphuric acid is cooled and reach a maximum between 130° and

120°, when a sharp explosion results. Below 120° the violence of the action diminishes, until, at 60°, chlorine peroxide is quietly evolved without crackling or detonation.

Discussion.

Sir William Ramsay suggested that the first action of sulphuric acid on potassium chlorate is the potential formation of chloric anhydride, Cl_2O_5. This decomposes into Cl_2 and 5O, and the oxygen is partly used in oxidising chlorine to perchloric acid. The usual equation, therefore,

$$3KClO_3 = KClO_4 + 2ClO_2 + K_2O$$

must be indeterminate.

The President asked whether Mr. Smith had ever obtained pure chlorine peroxide from a chlorate and sulphuric acid, as in his own experience he had always found that oxygen was given off in varying quantity as the change went on, and some free chlorine was liberated.

*130. "Mechanism of tautomeric change." By Henry Thomas Tizard.

In all cases of tautomeric change where one form is more highly ionised than the other (including pseudo-acids and bases, besides substances like ammonium cyanate), the question arises, Is the change primarily due to the undissociated molecules or to the products of its dissociation? Both views have found support. Walker and Hambly thought that they had proved that the change of ammonium cyanate into carbamide was brought about by the interaction of the two ions NH_4 and CNO. Dimroth (*Annalen*, 1904, **335**, 1), on the other hand, held that in the case of his triazole derivatives only the undissociated part changed. Goldschmidt (*Zeitsch. Elektrochem.*, 1905, **11**, 5) showed that either hypothesis was tenable in all cases, for if the rate of change is proportional to the concentration of the undissociated part, it is also proportional to the product of the concentrations of the ions, and vice versa. Thus, if in the change of the ionisable XOH into HXO we find that

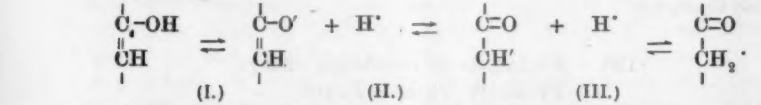
$$-\frac{dC_{XOH}}{dt} = k \cdot C_{XOH},$$

we also have $$K \cdot C_{XOH} = C_X \cdot C_{OH},$$

and therefore $$-\frac{dC_{XOH}}{dt} = \frac{k}{K} \cdot C_X \cdot C_{OH}.$$

Hence determination of rates of change affords no direct evidence in favour of either hypothesis. Indirect evidence of a kind can be

obtained by changing the solvent. For instance, the degree of dissociation and rate of change of ammonium cyanate in water and in 90 per cent. alcohol have been determined; from the results it can be shown that if the change is due to the undissociated part, it is about eight times as fast in alcohol as in water; if to the ions, it is nearly one hundred times as fast. The former seems much more probable. Similar conclusions follow from Dimroth's work on the rate of change of the triazoles in various solvents. So, too, instead of changing the solvent, we can substitute a similar tautomeride of a different degree of dissociation. This method has been adopted by Sidgwick and Rivett (*Trans.*, 1909, **95**, 899). This argument, however, is not conclusive, and, indeed, there are many substances which change more rapidly the greater the ionising power of the solvent. It is then usual to assume that the change takes place by the interaction of the ions. Before we accept this view it might be as well to consider rather more closely what it involves. Such a change must take place in three stages:



(I.) (II.) (III.)

Of these, (I) and (III) are strictly ionic reactions, and therefore must be instantaneous. The slow change on which the whole velocity depends must therefore be (II), that is, the rearrangement of the anion. This must depend only on the concentration of the anion. The tautomeric change must thus be proportional, not to the product of the concentrations of the two ions, but to the concentration of the anion alone. If a mineral acid were added, the concentration of the anion, and therefore the rate of reaction, would diminish. In no single case investigated has this behaviour been found. Addition of hydrochloric acid invariably has an accelerating effect, and this is proportional to the increase in the product of the concentration of the two ions. The only way in which this difficulty can be overcome is by supposing that the second ion has a catalytic effect. The rate of change will then be proportional to the concentration of both ions. This is of course in agreement with facts, but it may well be doubted whether it offers a satisfactory or even a plausible explanation. If in all the reactions examined, the second ion were hydrogen, we might be compelled to admit the possibility of this peculiar catalytic action of one ion on another, but the phenomenon seems to be quite general, and entirely unconfined to one particular ionic species. Pseudo-bases, where the second ion is hydroxyl, behave exactly like pseudo-acids, and so do even such substances as ammonium cyanate and its analogues, where the second ion is ammonium or a substituted ammonium.

These considerations seem to show that in no case of tautomerism is it probable that the change is brought about directly through the ions, although the rate may of course be influenced by a factor which also influences the ionisation. The changing substance must always be the undissociated molecule.

Discussion.

Dr. Flürscheim suggested that the tautomeric changes in the triphenylmethyl series might throw some light on the problem. The reactivity of some para-substituents in compounds, such as the triphenylmethyl halogenides, necessitated the assumption of a reversible change from the benzenoid to the quinonoid form. If this change occurred in the undissociated molecule, then, hydrogen being more mobile than halogen, tautomeric change of the quinonoid form (I) of unsubstituted triphenylmethyl bromide would produce *p*-bromotriphenylmethane. If, however, the change occurred in the ion, then, an electric charge being more mobile than hydrogen, tautomeric change of the quinonoid form (II) would give the original triphenylmethyl bromide.

$$(C_6H_5)_2C{:}C_6H_4{<}^{H}_{Br} \qquad (C_6H_5)_2C{:}C_6H_4{<}^{H}_{\oplus}.$$

(I.) (II.)

Since the latter alternative corresponded with experimental observation, the tautomeric change, in this case at least, must take place in the ion.

Dr. Sidgwick asked, with reference to Dr. Lapworth's remarks, how the catalytic effect of bases could be attributed to the formation of salts. The fact that in the case of nitrocamphor the effect of piperidine was so enormously greater than that of alkali seemed to show that some other factors were concerned.

*131. "A new sulphide of nitrogen." By Frank Playfair Burt.

When yellow nitrogen sulphide, N_4S_4, is sublimed in a vacuum over silver gauze heated to 100°, a small quantity of a blue substance is formed, although most of the nitrogen sulphide is deposited unaltered.

The blue substance has been shown by analysis to have the same percentage composition as the yellow sulphide.

Discussion.

The President inquired what was the temperature of the tube at the point where the blue sulphide was first formed, and whether the

yield of the new sulphide was increased in the absence of the silver gauze.

Mr. BURT stated that the temperature of the tube where the blue sulphide first began to deposit was approximately that of the room. In the absence of silver gauze, no blue sulphide at all was formed.

***132. "The molecular complexity, in the liquid state, of amines, nitriles, and amides." (Preliminary note.) By William Ernest Stephen Turner and Ernest Wyndham Merry.**

An investigation has been carried out, based on Ramsay and Shields's method, of the molecular complexities in the liquid state of thirteen amides and anilides, eleven nitriles and eleven amines.

In view of the quickened interest taken in the problem of solution, largely through the investigation, by Walden, of the solvent powers of organic media, including formamide, it was considered desirable to state that formamide exists, as a liquid, in a state of high molecular association. The association is, in fact, greater than in the case of water, and the authors suggest that the solvent action of formamide on salts, so similar to that of water, can be ascribed to the similar molecular complexity of the two substances.

All the amides investigated exist in an associated state; of the nitriles, only those of the aliphatic series show association.

Primary amines are slightly associated. Substituted amines show a remarkable and interesting behaviour. The value of Ramsay and Shields's constant rises both with the number of hydrogen atoms substituted and with the weight of the substituting group. With tribenzylamine, the value of k is 3·50—3·60.

***133. "A third active principle in ergot extracts." (Preliminary note.) By George Barger and Henry Hallett Dale.**

In addition to the active principles previously described by the authors as present in ergot and its extracts, namely, ergotoxine (*Trans.*, 1907, **91**, 337; *Biochem. J.*, 1907, **2**, 286) and *p*-hydroxyphenylethylamine (*J. Physiol.*, 1909, **38**, lxxvii; *Trans.*, 1909, **95**, 1123), there remained for identification the substance responsible for the intense activity exhibited by some ergot extracts in producing contraction of the isolated, *non-pregnant* uterus of the cat (compare Kehrer, *Arch. exp. Path. Pharm.*, 1908, **58**, 366).

As Kehrer found, this action is specially characteristic of Wernich's *Ergotinum dialysatum*. The relative abundance of this principle in dialysed extracts suggested that it was wholly or partly produced by micro-organisms, and this supposition was confirmed by physio-

logical experiment. It was also found that commercial extracts of meat and of yeast have a similar activity in smaller degree. Applying Kutscher's method (*Zeitsch. Nahr. Genussm.*, 1905, **10**, 528; 1906, **11**, 582) for separating bases from meat-extract, the authors obtained the active principle from ergotinum dialysatum as a silver compound by adding silver nitrate in excess and then baryta. The hydrochloride of the physiologically active base, obtained from this silver precipitate, is readily soluble in cold methyl alcohol, less so in hot ethyl alcohol, and very sparingly so in cold ethyl alcohol. After suitable purification, a minute quantity of a crystalline picrate, melting at 220—230°, and a picrolonate, very sparingly soluble in boiling water and melting at about 250°, were obtained. The base regenerated from either salt had an intense action on the uterus, and gave Pauly's reaction with *p*-diazobenzenesulphonic acid. This, together with the conditions under which the base was precipitated by baryta in the presence of silver nitrate, suggested that it was a derivative of histidine. Histidine itself was found to be inactive, but acquired a trace of activity on heating, and became markedly so when exposed to putrefaction. It therefore seemed probable that the active base was β-iminazolylethylamine, produced from histidine

by loss of carbon dioxide in the same way that *p*-hydroxyphenylethylamine in ergot extracts is produced from tyrosine.

This provisional identification is supported by the fact that the properties of the hydrochloride, picrate, and picrolonate above described correspond closely with those of the salts of β-iminazolylethylamine synthesised by Windaus and Vogt (*Ber.*, 1907, **40**, 369), and quite recently obtained by Ackermann (*Zeitsch. physiol. Chem.*, 1910, **65**, 504) by the putrefaction of histidine.*

134. "Volumetric estimation of manganese in manganese ores." By H. V. Krishnayya.

The process consists of a combination of two well known methods, namely, the basic acetate separation of iron and the permanganate titration for manganese. The hydrochloric acid solution containing

* Dr. Ackermann's kindness, which the authors gratefully acknowledge, has since enabled them to complete the identification by direct comparison of the base from ergot with that which he obtained by the putrefaction of histidine. In the crystalline form of their picrates, and particularly in their action on the uterus, the two bases were found to be identical.

0·2 gram of the ore is carefully neutralised with sodium carbonate, diluted to 400 c.c., and precipitated with 0·5 gram of sodium acetate. The boiling solution, without filtering off the iron precipitate, is then titrated with *N*/10-permanganate solution.

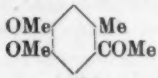
135. "Indirect estimation of copper." By Tarak Nath Das.

Both copper and cupric sulphide dissolve in dilute sulphuric acid on boiling with excess of potassium chlorate.

A volumetric estimation of copper based on this reaction (as regards cupric sulphide) was suggested.

136. "Synthesis of 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid." By Victor John Harding and Charles Weizmann.

By the condensation of acetyl chloride and homocatechol dimethyl ether, the authors have obtained 4 : 5-*dimethoxy-o-methylacetophenone* (I). On oxidation with warm alkaline potassium per-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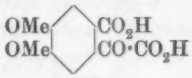
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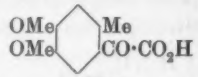
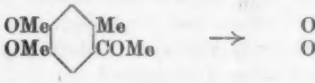

(III.)

manganate this ketone gives 6-carboxy-3 : 4-dimethoxyphenylglyoxylic acid (II) (*Trans.*, 1902, **81**, 1022). The intermediate oxidation product (III) has also been isolated.

When acted on by nitric acid, 4 : 5-dimethoxy-*o*-methylacetophenone gives nitrohomocatechol dimethyl ether, a direct displacement of the acetyl by the nitro-group occurring:



137. "Note on the paper of Dr. A. Slator and Dr. H. J. S. Sand on 'the rôle of diffusion in fermentation by yeast-cells.'" By Horace T. Brown.

In the course of the discussion which followed the reading of the above paper (this vol., p. 85), the author expressed an opinion that provided the gradient of concentration of the sugar at the immediate surface of the yeast-cell is known, and also the amount of sugar fermented by a cell in unit of time, it should be possible to determine the minimal concentration requisite to supply the cell with its requirements by diffusion only by means of a simple mathematical treatment

which renders it unnecessary to take into account the particular mode of diffusion within the cell itself.

On further consideration, and after discussing this point with Dr. Slator, the author has arrived at the conclusion that such a simplification of the problem would only be applicable if, at the limiting value of the concentration, the cell functions as a perfect absorber, that is to say, if the transformation of the sugar takes place at its immediate surface, which is almost certainly not the case. Under all other conditions, internal diffusion becomes a factor which has to be taken into account.

The authors of the paper are therefore correct in their statement that for the determination of the minimal concentration of a sugar solution which will just supply the cell with its requirements by diffusion only, it is necessary to make certain initial assumptions with regard to the distribution of enzyme within the cell.

138. "The resolution of gnoscopine (*dl*-narcotine)." (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson.

The authors have succeeded in resolving gnoscopine by the fractional crystallisation of its *d*-bromocamphorsulphonate from ethyl acetate. The first fraction consisted mainly of *l-narcotine* d-*bromocamphorsulphonate*, which, after recrystallisation, melted and decomposed at 110—120° and had $[\alpha]_D$ +97·2° in chloroform.

The second fraction consisted also mainly of this salt, and the mother-liquors, when left in the ice chest, deposited a large crop of crystals of *d*-narcotine *d*-bromocamphorsulphonate mixed with a quantity of the gnoscopine salt. The latter was removed by treatment with ethyl acetate, in which the *d*-narcotine salt is sparingly soluble, and, after crystallisation, the residue was found to be d-*narcotine* d-*bromocamphorsulphonate*, which melted at 170—185° and had $[\alpha]_D$ −29·0° in chloroform. When liberated from their salts by treatment with alcoholic ammonia, the alkaloids exhibited the following properties in chloroform solution:

l-Narcotine from gnoscopine: $[\alpha]_D$ − 199·8°.
d-Narcotine „ „ „ + 199·9°.
l-Narcotine from opium „ − 199·9°.

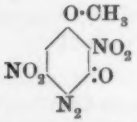
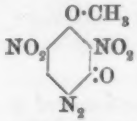
All these specimens melted at 174—175° (uncorr.).

On mixing hot alcoholic solutions of *d*- and *l*-narcotine, crystals of gnoscopine, melting at 230°, separated at once. *d*-Narcotine had not previously been described, and the authors propose to submit it to physiological examination. A short time since (this vol., p. 46), the authors described a synthesis of gnoscopine from cotarnine and meconine, and as Salway (*ibid.*, 98) has lately synthesised the former

substance, the synthesis of the inactive and active modifications of narcotine is now complete. The resolution of gnoscopine was rendered possible by the generosity of Messrs. T. and H. Smith, of Edinburgh, who placed 100 grams of this rare opium alkaloid at the authors' disposal. The authors are also indebted to Prof. W. J. Pope for the *d*-bromocamphorsulphonic acid required for this research.

139. "The products of diazotisation of the trinitro-*p*-anisidines." By Raphael Meldola and Frédéric Reverdin.

The two isomerides, 2 : 3 : 5- and 2 : 3 : 6-trinitro-*p*-anisidine, both lose the 3-nitro-group on diazotisation, and give rise to the quinone-diazides:

A description was given of these compounds and of their azo-β-naphthol derivatives. The results of the diazotisation of these trinitro-anisidines, taken in conjunction with those of former researches, bring out very clearly the extreme mobility of the 3-nitro-group as compared with the methoxy-group under comparable conditions of displaceability.

140. "*m*-Hemipinic and asaronic acids." By Bernard Dunstan Wilkinson Luff, William Henry Perkin, jun., and Robert Robinson.

Although *m*-hemipinic acid is an acid of considerable importance, especially in connexion with researches on natural products, it is difficult to obtain in quantity, and the following experiments were instituted with the object of discovering a convenient method for its preparation. Creosol methyl ether is nitrated, and the resulting nitrocreosol methyl ether reduced by tin and hydrochloric acid to 4 : 5-*dimethoxy-o-toluidine* (I), which melts at 109°.

This amino-derivative is then converted by Sandmeyer's reaction into *dimethoxy-o-toluonitrile* (II), which melts at 81° and, on hydrolysis with barium hydroxide, yields dimethoxy-*o*-toluic acid (III), which has already been prepared by Perkin and Weizmann (*Trans.*, 1906, **99**, 1651). This acid is oxidised by alkaline permanganate quantitatively to *m*-hemipinic acid (IV).

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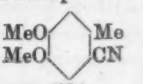
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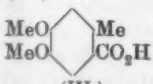
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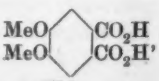
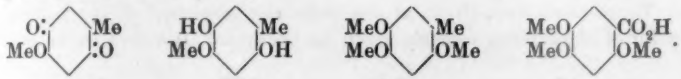
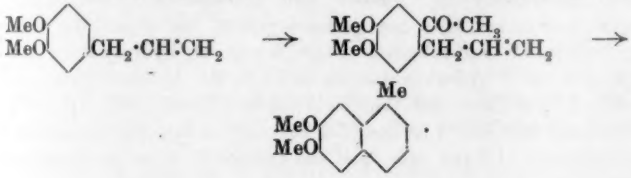

(IV.)

Considerable quantities of *m*-hemipinic acid have been prepared in this way, and the following observations were also made during the course of this research. Aminocreosol methyl ether (I) is readily oxidised by ferric chloride to 4-*methoxy*-2 : 5-*toluquinone* (V), which crystallises in golden spangles, melts and decomposes at 170—172°, and is reduced by sulphurous acid to the corresponding quinol (m. p. 123°; VI). The latter is converted by methyl sulphate into 2 : 4 : 5-*trimethoxytoluene* (VII), which melts at 55° and, on oxidation with permanganate, yields asaronic acid (VIII).



(V.) (VI.) (VII.) (VIII.)

When eugenol methyl ether is treated with acetyl chloride in the presence of aluminium chloride, a substance is produced which melts at 114°, and is evidently 6 : 7-dimethoxy-1-methylnaphthalene.



141. "**The influence of radium emanation on equilibrium in a gaseous system : a correction.**" **By Francis Lawry Usher.**

The velocity-constant for the decomposition of ammonia by emanation has been recalculated from data already published (*Trans.*, 1910, **97**, 389).

142. "**The intramolecular rearrangement of the halides of phenazothionium.**" **By Harold James Page and Samuel Smiles.**

It was shown that the chlorides of the simpler derivatives of phenazothionium are converted by the action of warm hydrochloric acid into the corresponding chloro-compounds of thiodiphenylamine. Displacement of hydrogen in the benzenoid systems of thiodiphenylamine by the nitro- and similar groups seems to hinder this reaction. The complete process of chlorination of thiodiphenylamine has thus been accomplished, the two intermediate products—the sulphoxide and phenazothionium salt—having now been isolated. The exhaustive chlorination of thiodiphenylamine may be carried out without isolating these intermediate compounds; hydrogen dioxide and hydrochloric acid furnish tetrachlorothiodiphenylamine.

143. "A study of the Landsberger-Sakurai boiling-point method of determining molecular weights." By William Ernest Stephen Turner.

The author criticised the Landsberger-Sakurai method and its modifications, and described the nature and value of the corrections needed to make the method available for the determination of series of molecular weights at different dilutions. A simple form of apparatus whereby such determinations can be carried out was described.

The revised value, 39·0, of the molecular elevation of the boiling point of chloroform, recently given by Beckmann, has been confirmed.

144. "The salts of 8-hydroxyquinoline." By John Jacob Fox.

The salts of 8-hydroxyquinoline have been prepared and found to dissolve appreciably in benzene and chloroform. The copper, cadmium, and nickel salts are greenish-yellow, the remaining salts being yellow- or buff-coloured. The degree of hydrolysis of the sodium salt of 8-hydroxyquinoline and of the hydrochloride was determined by Farmer and Warth's method (*Trans.*, 1901, **79**, 863). It was found that in a 0·1*N*-solution the sodium salt was hydrolysed to the extent of 11·6 per cent., and the hydrochloride to the extent of 4·2 per cent.

8-Hydroxyquinoline and its salts, 8-ethoxyquinoline and its hydrochloride, 5 : 7-dibromo-8-hydroxyquinoline, and 8-hydroxy-1 : 2 : 3 : 4-tetrahydroquinoline and its hydrochloride were examined spectrographically in alcoholic solution. The yellow colour of the salts was shown to be due to the extension of the bands of the original substances into the visible region, the general form of the curves for absorption being similar in the derivatives of 8-hydroxyquinoline and its salts. The curves obtained from hydroxytetrahydroquinoline and its hydrochloride, were of a different character from that of hydroxyquinoline, and resembled those obtained from alkylated anilines.

145. "Apparatus for demonstrating the volumetric compositions of gases." By Alaric Vincent Colpoys Fenby.

The apparatus described was devised for the rapid demonstration of the combining volumes of gases and of the compositions of compound gases. The volumes of gases introduced are simple multiples of a *unit* volume (15 c.c.) equal to one division on the burette, which is divided into six parts. The pressure is adjusted to atmospheric

pressure at each measurement, and no corrections for temperature or pressure are required.

The apparatus consists of four parts, namely, (1) the gas burette, of special design; (2) the levelling tube; (3) a reservoir for filling the burette, and (4) a special form of gas generator and holder, by which fixed volumes of a gas can be passed into the burette. The whole is conveniently supported on a single retort stand.

The use of the apparatus for the following experiments was described: Composition of ammonia by the chlorine method; combination of hydrogen and chlorine in equal volumes; combining volumes of hydrogen and oxygen; the composition of carbon monoxide and hydrocarbon gases, and the decomposition of hydrogen chloride by sodium amalgam.

Special features of the apparatus include the generation of chlorine in the burette; the method of introducing fixed volumes of gas into the burette from the generator, and the construction of the generator itself and the burette.

146. "Some reactions of benzyl mercaptan. Benzyl tri- and tetrasulphides." By John Armstrong Smythe and Aquila Forster.

When a solution of benzyl mercaptan in glacial acetic acid is saturated with sulphur dioxide and hydrogen chloride, a quantitative reaction takes place according to the equation:

$$4C_6H_5\cdot CH_2\cdot SH + SO_2 = (C_6H_5\cdot CH_2)_2S_2 + (C_6H_5\cdot CH_2)_2S_3 + 2H_2O.$$

Benzyl trisulphide melts at 49°, and possesses considerable crystallising powers. It forms a sparingly soluble *additive product*,

$$(C_6H_5\cdot CH_2)_2S_3,AgNO_3$$

(m. p. 96°), with silver nitrate. The action of sulphur dioxide on benzyl mercaptan thus resembles that of thionyl chloride on mercaptans (Holmberg, *Annalen*, 1907, **359**, 81), and the results throw some light on Jones and Tasker's work (*Trans.*, 1909, **95**, 1910).

Benzyl mercaptan and benzyl disulphoxide condense in the presence of glacial acetic acid and a current of dry hydrogen chloride, water being formed, the disulphoxide reduced to disulphide, and the mercaptan oxidised to disulphide:

$$(C_6H_5\cdot CH_2)_2S_2O_2 + 4C_6H_5\cdot CH_2\cdot SH = 3(C_6H_5\cdot CH_2)_2S_2 + 2H_2O.$$

Similarly, benzyl disulphoxide in the presence of glacial acetic acid and dry hydrogen chloride condenses with hydrogen sulphide, forming benzyl disulphide, water, and sulphur:

$$(C_6H_5\cdot CH_2)_2S_2O_2 + 2H_2S = (C_6H_5\cdot CH_2)_2S_2 + 2H_2O + S_2.$$

These condensations are quantitative.

Benzyl sulphoxide does not condense in this way when sodium ethoxide or acetic anhydride are used as condensing agents.

Benzyl tetrasulphide, together with hydrogen chloride, is formed by the interaction of benzyl mercaptan and sulphur chloride, thus:

$$2C_6H_5\cdot CH_2\cdot SH + S_2Cl_2 = (C_6H_5\cdot CH_2)_2S_4 + 2HCl.$$

The new sulphide is a white, crystalline powder, soluble in alcohol, benzene, etc., insoluble in water, and melting at 49—50°. It forms no additive products with methyl iodide or with silver nitrate. Nascent hydrogen reduces it, giving benzyl mercaptan and hydrogen sulphide, and chlorine attacks it in the cold with the formation of sulphur chloride and benzyl chloride. In glacial acetic acid solution it is oxidised by hydrogen peroxide.

147. "The action of sodium or potassium hydroxides on sodium alkyl thiosulphates and on disulphides." By Thomas Slater Price and Douglas Frank Twiss.

The authors referred to the criticism by Fromm and Erfurt (*Ber.*, 1909, **42**, 3816) of their explanation of the course of the reaction between alkalis and the sodium alkyl thiosulphates, and pointed out that there is no satisfactory experimental evidence for the formation of intermediate compounds of the type R·S·OH, postulated by Gutmann (*Ber.*, 1908, **41**, 1650) and favoured by Fromm and Erfurt.

In connexion with the action of alcoholic potassium hydroxide on benzyl disulphide, it was shown that if benzyl chloride is added to the mixture after the reaction has taken place, and the mixture again heated, the main products are benzyl sulphide and benzoic acid, whereas if benzyl chloride is present from the commencement, a considerable quantity of the benzylmercaptal of benzaldehyde is also formed. From these results it was deduced that the primary result of the action of alkali on benzyl disulphide is the formation of benzyl mercaptan and benzoic acid.

148. "Carboxylic acids of *cyclo*hexanone and some of its derivatives." (Preliminary note.) By Henry Dent Gardner, William Henry Perkin, jun., and Hubert Watson.

These acids are obtained when the cyclic ketones are treated, in ethereal solution, with sodamide and carbon dioxide.

$$CH_2\langle\begin{matrix}CH_2\cdot CH_2\\CH_2\cdot CH_2\end{matrix}\rangle CO \longrightarrow CH_2\langle\begin{matrix}CH_2\cdot CHNa\\CH_2\text{—}CH_2\end{matrix}\rangle CO \longrightarrow$$

$$CH_2\langle\begin{matrix}CH_2\cdot CH(CO_2H)\\CH_2\text{———}CH_2\end{matrix}\rangle CO.$$

cyclo*Hexanone*-2-*carboxylic acid* softens at 79°, melts and decomposes at 81—82°, and, on reduction with sodium amalgam, yields *cyclo*hexanol-2-carboxylic acid (hexahydrosalicylic acid), which melts at 111°.

1-*Methyl*cyclo*hexan*-2-*one*-3-*carboxylic acid* is a syrup.

d-1-*Methyl*cyclo*hexan* - 3 - *one* - 2(?) - *carboxylic acid*, prepared from 1-methyl*cyclo*hexan-3-one from pulegone, melts at 103°, and has $[\alpha]_D$ + 97·2°. *dl*-1-*Methyl*cyclo*hexan* - 3-*onecarboxylic acid*, prepared from *dl*-1-methyl*cyclo*hexanone, melts at 100°.

1 *Methyl*cyclo*hexan*-4-*one*-3-*carboxylic acid* melts at 101°, and, on reduction with sodium amalgam, yields 1-*methyl*cyclo*hexan*-4-*ol*-3-*carboxylic acid*, which melts at 114° and, when heated, yields a *methyl*-cyclo*hexenecarboxylic acid*, which distils at 153°/25 mm. and crystallises. This acid is being investigated with the object of determining the position of the double linking.

Menthonecarboxylic acid melts at 154°, and *thymomenthone-carboxylic acid* at 150—151°.

All those acids which contain the grouping $\cdot CO \cdot CH \cdot CO_2H$ give intense colorations when ferric chloride is added to their alcoholic solutions.

Thursday, June 2nd, 1910, at 8.30 p.m., Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. W. P. Bloxam and Hubert L. Lucking were formally admitted Fellows of the Society.

Of the following papers, those marked * were read:

***149. "The interaction of nickel carbonyl and carbon disulphide." By Sir James Dewar and Humphrey Owen Jones.**

Nickel carbonyl and carbon disulphide vapours interact readily at the ordinary temperature to form carbon monoxide and a bronze-coloured deposit containing nickel, sulphur, and carbon; the liquids, on the other hand, interact only to a very slight extent.

An examination of the volume changes when the two vapours are allowed to react in a specially devised apparatus shows that the reaction is probably represented by the equation (II) rather than (I):

$$2Ni(CO)_4 + CS_2 = 2NiS + 8CO + C \quad . \quad . \quad . \quad (II)$$

$$Ni(CO)_4 + CS_2 = NiS + 4CO + CS \quad . \quad . \quad . \quad (I).$$

The reaction, however, is incomplete, proceeds more extensively at low pressures than at higher pressures, and is completely inhibited by the presence of carbon monoxide of a sufficient concentration. Thus, for example, there is no change in a mixture containing nickel carbonyl vapour under 37·5 mm., carbon disulphide vapour under 32·5 mm., and carbon monoxide under 68·5 mm. pressure.

In order to account for the influence of carbon monoxide on the reaction, and for the fact that the reaction, although not reversible, is incomplete, it is suggested that the actual reaction takes place, not between molecules of nickel carbonyl and carbon disulphide, but between free nickel produced by the dissociation of nickel carbonyl and carbon disulphide. The initial concentration of free nickel in the vapour of nickel carbonyl would be small, and would be much reduced by the presence of carbon monoxide, to which the dissociation of nickel carbonyl is very sensitive. Consequently, the presence of carbon monoxide would tend to inhibit the reaction until it would finally come to standstill.

Discussion.

The President asked whether it was not *nascent* nickel that reacted with the carbon disulphide vapour. Had the authors observed whether the vapour of nickel carbonyl showed appreciable dissociation throughout its mass when admitted to a vacuous bulb, or whether the dissociation only took place in contact with the glass surface?

Dr. Jones replied that the behaviour of nickel carbonyl vapour at low pressures indicated that dissociation takes place in contact with the glass surface, and the interaction with carbon disulphide appeared to take place similarly.

***150. "Synthesis of cotarnine." By Arthur Henry Salway.**

The author described in detail an investigation, of which a preliminary account has recently been given (this vol., 98).

Discussion.

In reply to Dr. Barger, Dr. Salway pointed out that the synthesis of cotarnine is complete, since myristicinaldehyde has been prepared by the author from myristicinic acid, which in turn is readily obtained from cotarnic acid (Roser, *Annalen*, 1889, **254**, 348). The synthesis of cotarnic acid has already been accomplished (Perkin, Robinson, and Thomas, *Trans.*, 1909, **95**, 1977).

*151. "**The accuracy of the gold bullion assay.**" **By John Phelps.**

The author has examined a number of results obtained in the assay of gold bullion from the point of view of the probable error.

The following points were considered:

1. Gold assays made in the course of routine work in the assay department of the Royal Mint.

2. (*a*) Assays of "trial plates" and comparisons of samples of "proof" gold; (*b*) Comparison of proof gold made in the Mint laboratory with that produced by the Utrecht Mint.

3. Comparison of the results of assays made at the Royal Mint with the results of other assayers working on the same material.

4. Discussion on the same lines of results recorded in a paper by F. P. Dewey ("The Assay and Valuation of Gold Bullion," *Trans. Amer. Inst. Mining Engineers*, 1909).

The author finds that ordinary gold assays weighed to 0·05 per 1000 are subject to a probable error of ±0·043 per 1000, while in the case of special assays weighed to 0·01 per 1000, the probable error of a single assay may be reduced to ±0·032 per 1000.

From this it is concluded that the error in the mean of 20 assays made with the greatest care should not exceed 0·01 per 1000.

*152. "**Morphological studies of benzene derivatives. Part I. Introductory.**" **By Henry E. Armstrong.**

The studies referred to were instituted with the object of ascertaining the general and particular effect of alterations in molecular structure—especially of alterations in the orientation in the molecule of similar radicles—on crystalline form in the case of the extensive series of isomeric tri-derivatives obtained on introducing two like or unlike halogen atoms and the sulphonic radicle in its various forms into benzene. The plan of the work was explained and a general account was given of the course it has taken. The inquiry has been prosecuted in the author's laboratory during the past fifteen years but the significance of the results arrived at has been apparent only since the development of the Barlow-Pope theory of the interconnexion of external crystalline form and internal molecular structure: the results appear to afford singular confirmation of the theory.

*153. "**Morphological studies of benzene derivatives. Part II. Sulphonic derivatives of the 1 : 4-di-derivatives of benzene containing halogens.**" **By Reginald Thomas Colgate and Ernest Harry Rodd.**

Twenty-seven compounds of the 1 : 4-series have been measured: the results were fully reported and discussed. The sulphonic

chlorides and bromides fall into the one or the other of two crystallographic series; one or two cases of dimorphism have been observed, however, which connect the two series; the connexion is further established by the fact that in some cases the sulphonic chloride crystallises in the one series whilst the corresponding bromide crystallises in the other, although, as a rule, there is very close resemblance between corresponding sulphonic chlorides and bromides. The sulphonanilides and the ortho-, meta- and para-toluidides also form an isodimorphous group; in most cases they are obtainable in a labile as well as in a stable form.

It was shown that all the compounds described can be arranged in one or the other of two series, one derived from the hexagonal, the other from the cubic mode of packing equal spheres—the two alternative modes which Barlow and Pope have shown to be possible in the case of benzene units. The results afford most striking evidence of the maintenance of a benzene framework in the molecules.

***154. "Behaviour of two salts with a common ion, when dissolved in an organic solvent." By James Charles Philip and Harold Reuben Courtman.**

The conductivity of solutions of tetraethylammonium iodide and potassium iodide, separately and together, in methyl and ethyl alcohols, methyl ethyl ketone, acetonitrile, and nitromethane has been determined at 25°. The examination of the separate salts has shown that between $v=50$ and $v=2000$ the equivalent conductivity is a linear function of the cube root of the concentration; that is, the empirical rule, $\lambda=\lambda_{\infty}-a\sqrt[3]{\eta}$, formulated by Kohlrausch for binary salts in aqueous solution, may be taken as valid also for these salts in organic solvents. On the basis of this rule it is possible by Barmwater's method to calculate the conductivity of a solution containing two salts with a common ion, on the assumption that in the mixture each salt behaves as if it were present alone at a concentration equal to the sum of the concentrations of the two salts. The agreement between the observed and calculated values is such as to suggest that the relation of two salts with a common ion in an ionising organic solvent is closely similar to the relation existing between them when dissolved in water.

Discussion.

Dr. Philip, in reply to a question, said that the differences between the observed and calculated values for the conductivity of the mixed iodides were greater than the experimental errors. Formamide had not been tried as a solvent. Like water, it was characterised by

a high dissociative power, and for such solvents the differences between the values for the conductivity of the mixed salts calculated by Barmwater's method and those calculated on an additive basis were considerably less than in solvents of weaker ionising power.

155. "The effect of contiguous unsaturated groups on optical activity. Part VI. The influence of molecular symmetry. Application to the relative rotatory powers of position-isomerides." By Thomas Percy Hilditch.

It was shown that, in an optically active compound completely symmetrical with respect to the geometrical centre of its molecule and containing at the same time adjacent unsaturated radicles, there usually exists a very anomalous degree of rotatory power. The direction of the anomaly (positive or negative) is not always the same, and, in particular, negative effects frequently occur when two or more unsaturated groups are in spacial proximity. Similar, but less pronounced, phenomena accompany the presence of partial molecular symmetry coupled with unsaturation.

This effect, together with that due to the conjunction in space of two unsaturated groups (*Trans.*, 1909, **95**, 1577), appears in some measure to explain the deviations frequently observed from Guye's hypothesis (in its simplest qualitative form) in the rotatory powers of optically-active position-isomerides. By utilising derivatives of trisubstituted benzene compounds (such as the phenolic camphor-β-sulphonates) it has been possible to differentiate between the maximum effects due respectively to symmetry (1 : 3 : 5-isomeride) and to the influence of mass (1 : 3 : 4-isomeride), both of which are concentrated in the para-derivative in disubstituted compounds.

156. "The action of Grignard reagent on camphoric and *iso*-camphoric esters." By Yūji Shibata.

The author has recently shown (*Trans.*, 1909, **95**, 1449) that the action of the Grignard reagent on phthalic esters results in the formation of derivatives of phthalide or those of phthalan, whilst glycols are produced from succinic and terephthalic esters, and the conclusion was drawn that the two CO_2R groups in phthalic esters are in the *cis*-position, whilst those in succinic and terephthalic esters are in the *trans*-position. In order to obtain further confirmation of this view, the author has now examined the action of the Grignard reagent on camphoric and *iso*camphoric esters, these being definitely known to be *cis-trans*-isomerides. In accordance with the anticipation, dimethyl

camphorate, an ester of the *cis*-acid, gave campholides, whilst dimethyl *iso*camphorate, an ester of the *trans*-acid, gave the non-condensed ester of diphenylhydroxy*iso*campholic acid. By the action of magnesium *iso*propyl iodide on dimethyl camphorate, a substance, $C_{14}H_{24}O_3$, probably methyl 1 : 2 : 2-trimethyl-3-*iso*butyryl*cyclo*pentane-1-carboxylate, was obtained. The author also discussed the constitution of dimethylcampholide obtained by G. Komppa (*Ber.*, 1908, **41**, 1039).

157. "Some aromatic antimony compounds." (Preliminary note.)
By Percy May.

By the action of hot fuming nitric acid on triphenylstibine, Michaelis and Reese (*Annalen*, 1886, **233**, 52) obtained triphenylstibine nitrate, $(C_6H_5)_3Sb(NO_3)_2$, melting at 156°. The author has, however, succeeded in nitrating the benzene nuclei of triphenylstibine, and has obtained a well crystallised *trinitro*-derivative melting at 191°. This, on reduction with zinc dust and glacial acetic acid, yields the corresponding amino-compound, which can be recognised by the usual tests, but has not yet been isolated in the pure condition. A very small quantity of *tri*-p-*aminophenylstibine* has, however, been obtained by the action of sodium on a solution of antimony trichloride and *p*-chloroaniline in benzene solution. The extreme smallness of the yield is not surprising, as an insoluble compound is formed when a benzene solution of antimony chloride is added to a solution of *p*-chloroaniline in the same solvent, the formation of which tends to prevent the reaction from proceeding. Analysis indicates that this compound is formed by the union of one molecule of antimony chloride with one of chloroaniline. Antimony chloride does not appear to form similar compounds with aniline or with *p*-chlorophenol.

An attempt has been made to sulphonate triphenylstibine, and although it was evident that sulphonation had taken place, no pure compound has, as yet, been isolated from the reaction product.

It is proposed to prepare other substituted derivatives of triphenylstibine by the method indicated above, and also to study the derivatives of the amino-compound.

158. "Note on the cobaltinitrites."
By Mary Cunningham and Frederick Mollwo Perkin.

In a recent paper (*Trans.*, 1909, **95**, 1562), the authors gave a method for the preparation of sodium cobaltinitrite which was found to furnish the best results. Prof. E. Biilmann points out that an almost

identical method has been previously described by him. The authors regret that, in searching the literature, the communication of Prof. Biilmann had escaped their attention.

159. "Acetone derivatives of *d*-fructose." By James Colquhoun Irvine and Charles Scott Garrett.

The condensation of fructose with acetone gives three fructose-monoacetones, two of which, on continued action, condense with a second molecule of the ketone, giving rise to the α- and β-fructose-diacetones previously described by Fischer. The formation of these three isomerides was explained on stereochemical grounds, and necessitates an extension of the nomenclature of sugar derivatives.

α-Fructosemonoacetone was obtained by the partial hydrolysis of α-fructosediacetone by the action of 0·1 per cent. of hydrogen chloride at 30°. Under these conditions only the non-glucosidic acetone residue is removed. The compound melts at 120—121°, and gave $[\alpha]_D^{20°}$ – 158·9° in aqueous solution. *β-Fructosemonoacetone* was obtained as a syrup, and was identified by analysis and by the formation from it of β-fructosediacetone. The third monoacetone compound is incapable of further condensation, and was characterised by conversion into trimethyl fructosemonoacetone(b. p. 120°/15 mm.) by the silver oxide reaction.

The α- and β-fructosediacetones have been further examined. The compounds show a remarkable difference in their behaviour towards hydrolytic agents. In each case the non-glucosidic group is the first to be removed, and this takes place with the α-compound under conditions towards which the β-isomeride is perfectly stable.

160. "The absorption spectra of 1 : 4-dihydronaphthalene and 1 : 2 : 3 : 4-tetrahydronaphthalene." By Alfred Godfrey Gordon Leonard.

Bamberger has shown that when reduction is confined to one of the nuclei in the naphthalene molecule, the properties of the compounds so produced are in close agreement with those of analogous benzene derivatives. These substances have been examined to ascertain if there might be any similar relationship between their respective absorption spectra, and the following conclusions are drawn: (1) The curves of 1 : 4-dihydronaphthalene and 1 : 2 : 3 : 4-dihydronaphthalene are similar, and occupy a position intermediate between the curves of naphthalene and *o*-xylene.

(2) The spectra are those of a benzenoid nucleus as modified by the presence of an aliphatic ring.

(3) Such spectra are in close agreement with the observed chemical properties of the two hydrides.

161. "The determination of malonic acid by potassium permanganate." By Alexander Thomas Cameron and Basil Charles McEwan.

In order to extend the observations of Marshall and Cameron on the succinates (*Trans.*, 1907, **91**, 1519) to the corresponding malonates, it was necessary to find a conveniently simple method for the quantitative estimation of malonic acid. Durand (*Ann. Chim. anal.*, 1903, **8**, 330) states that malonic acid can be estimated with potassium permanganate in acid solution at 80°, the formic acid, which is one of the products, reacting with the permanganate so slowly that a definite end point can be obtained. He writes the reaction as:

$$C_3H_4O_4 + 3O = H_2O + H_2CO_3 + 2CO_2 \quad . \quad . \quad . \quad (1).$$

Concentrated solutions of malonic acid and malonates decompose on boiling, with rapid evolution of carbon dioxide and production of acetic acid. Lamoureux (*Compt. rend.*, 1899, **128**, 998) states that this reaction commences at 68°. Any method requiring a temperature of 80° can evidently only be applied to dilute solutions.

Using Durand's original method, the authors have never obtained a definite end-point; this is due presumably to the slow but steady oxidation of the formic acid. On the other hand, the truth of the above equation can be easily shown qualitatively. When a dilute solution of malonic acid is distilled with acid permanganate, carbon dioxide is evolved, and the distillate contains formic acid.

An attempt was made to reduce the oxidation of the formic acid to a minimum by heating the malonic acid with excess of permanganate for a few minutes, reducing the permanganate remaining with oxalic acid, and titrating the excess of oxalic acid with more permanganate. According to equation (1), 1 gram of malonic acid is oxidised by 1·823 grams of potassium permanganate. In nine titrations the corresponding figure varied from 1·933 to 2·205 grams, showing no regularity.

If complete oxidation of the malonic acid took place, as expressed by the equation:

$$C_3H_4O_4 + 2O_2 = 2H_2O + 3CO_2 \quad . \quad . \quad . \quad . \quad (2),$$

1 gram of malonic acid would require 2·431 grams of permanganate. The actual results lie between the two figures, and it is evident that the method is inapplicable owing to the oxidation of an indeterminate amount of formic acid.

Formic acid is immediately oxidised by hot alkaline permanganate, whilst under the same conditions malonic acid is very slowly attacked;

hence complete oxidation of the malonic acid can be brought about by first heating with excess of acid permanganate, and then rendering the whole alkaline with excess of alkali.

This method was tested in the following manner. Either a weighed quantity of solid or (where the weight is given in brackets) a measured volume of standard solution of malonic acid was added to approximately 2*N*-sulphuric acid, excess of permanganate solution added, and the whole heated to 80—90° for ten minutes (or longer with the more dilute solutions); the solution was then rendered alkaline with strong aqueous potassium or sodium hydroxide, and the heating continued for some minutes; finally, excess of sulphuric acid was added, then for convenience excess of oxalic acid, and this excess determined with more permanganate.

The results are given below:

No. of experiment.	Weight of malonic acid.	Grams malonic acid per litre solution.	Grams $KMnO_4$ per gram malonic acid.	No. of experiment.	Weight of malonic acid.	Grams malonic acid per litre solution.	Grams $KMnO_4$ per gram malonic acid.
1	(0·2004)	2·85	2·382	6	0·1682	1·12	2·419
2	(0·2000)	1·42	2·431	7	0·1544	1·03	2·430
3	0·1942	1·30	2·449	8	(0·2100)	0·66	2·453
4	(0·2000)	1·25	2·451	9	(0·2048)	0·43	2·125
5	0·1850	1·23	2·449	10	(0·2048)	0·40	2·481
						Theory	2·431

The figures show that the explanation given is the correct one. At the same time they indicate the limits of dilution (calculated on the concentration at the commencement of the reaction) within which the method can be employed quantitatively. In the first experiment some decomposition of the malonate through heat has already taken place, whilst in the last two the results are uncertain. Further experiments on similar lines have indicated that to obtain accurate results it is essential to work below 90° (the reaction commences at about 70°, and proceeds rapidly between 80° and 85°) and to avoid great excess of sulphuric acid.

Mestrezat (*Ann. Chim. anal.*, 1907, **12**, 173) states that tartaric and malic acids react with potassium permanganate in the same manner, with the production of formic acid and carbon dioxide. He suggests a similar method for their estimation.

The case of citric acid (Wöhlk, *Zeitsch. anal. Chem.*, 1902, **41**, 77) is more complex, but the reaction proceeds on corresponding lines, the chief products being acetone and carbon dioxide.

It is evident that the permanganate reacts with all this series of acids in a parallel manner, and can therefore be used to estimate any one of them only in the proved absence of the others.

162. "The direct union of carbon and hydrogen. Synthesis of methane." Part II. By William Arthur Bone and Hubert Frank Coward.

In continuation of their previous experiments (*Trans.*, 1908, **93**, 1975), the authors are now able to report a not less than 95 per cent. yield of methane from less than 0·03 gram of highly purified sugar charcoal (containing not more than 0·06 per cent. of ash and less than 0·1 per cent. of hydrogen) by maintaining it in a steady current of pure dry hydrogen at 1150° for from seventeen to twenty-five hours continuously, thus completing the proof of the direct synthesis of methane from its elements at this temperature.

163. "The existence of racemic compounds in solution." By Albert Ernest Dunstan and Ferdinand Bernard Thole.

In continuation of their previous work (*Trans.*, 1908, **93**, 1815) the authors have investigated the viscosity-concentration relationships for various solutions of active and racemic compounds. The *sec.*-octyl hydrogen phthalates (*d*-, *l*-, and inactive forms) were examined in benzene solution, and were found to give identical curves. Hence the inactive ester does not exist in solution as a racemic compound.

The *d*-, *l*-, and *r*-mandelic acids have the same viscosity in aqueous and in pyridine solutions, but when the viscosities were determined in a non-dissociating solvent, such as amyl acetate, a clear difference between the active and inactive forms was apparent.

Adriani (*Zeitsch. physikal. Chem.*, 1900, **33**, 413) has already proved by Roozeboom's method that *r*-mandelic acid exists in the fused state.

In further support of the previous work on the tartaric acids, it was shown that a solution of racemic acid mixed with *d*-tartaric acid has a viscosity different from that of a solution of the pure *d*-acid of identical concentration.

164. "Note on the occurrence of osyritrin (violaquercitrin) in Osyris abyssinica." By Samuel James Manson Auld.

In an examination of "Pruimbast" or "Cape Sumach," *Osyris compressa* (*Colpoon compressum*), A. G. Perkin (*Trans.*, 1897, **71**, 1132) separated a glucoside, *osyritrin*, which he later showed to be identical with violaquercitrin, isolated previously by Mandelin (*Jahresber*, 1883, 1369) from *Viola tricolor*. Samples of Cape sumach have been

examined at the Imperial Institute from time to time, and no difficulty has been experienced in separating the osyritrin from them.

Recently a considerable consignment of the leaves and stalks of *Osyris abyssinica*, Höchst, has been received for examination from the Transvaal. The material as received gave a much deeper coloured extract than Cape sumach, and produced a darker leather of rather poor quality. The aqueous extract, on keeping, deposited a certain amount of solid matter, but this did not appear at all similar to the crystalline deposits previously obtained from *Osyris compressa*. The new material was therefore examined more closely.

The Tannins.—Analysis showed that the leaves contained about 23 per cent. of tannin.

The leaves were extracted with water and the extract evaporated to a small bulk, when there separated a quantity of solid matter consisting of colouring principle and the phlobaphen of the tannin. The aqueous solution was fractionally precipitated with lead acetate, and the last fraction washed and decomposed with hydrogen sulphide. After removal of the lead sulphide and the excess of hydrogen sulphide, the solution was evaporated to dryness. It yielded a reddish-brown tannin of the catechol series. This tannin is much darker than that previously obtained from *Osyris compressa*, and it also shows more readiness to lose water and form the phlobaphen.

Extraction of the Colouring Matter.—The coarsely-ground leaves were thoroughly extracted in a Soxhlet apparatus with 90 per cent. alcohol, and the residue, after removing the spirit, was poured into water. The green mass which separated was filtered off, and, after drying, was extracted separately with light petroleum and alcohol. The alcoholic extract set to a viscid, semi-solid mass on concentration. By pouring into excess of boiling water it was possible to separate a large quantity of dark brown insoluble matter of a phlobaphen nature, and on cooling the aqueous solution, a dirty brown solid deposit was obtained, which, after repeated precipitation with water from alcoholic solution, yielded a mass of small crystals. These were purified by several crystallisations from dilute alcohol and finally from boiling water.

A further quantity of the same substance was obtained by deposition from the main filtrate containing the tannin.

The substance formed small, greenish-yellow needles, melting at 189—190°, after softening at 185—186° (osyritrin melts at 186°). After being dried at 160°, it gave on analysis:

C = 53·17; H = 4·51. $C_{27}H_{28}O_{16}$ requires C = 53·28; H = 4·60 per cent.

After being dried at 160°: Found, H_2O = 7·90. $C_{27}H_{28}O_{16},3H_2O$ requires H_2O = 8·15 per cent.

On hydrolysis with dilute acid the substance gives an insoluble colouring matter and a sugar.

The latter is dextrorotatory, and gives an osazone melting at 204—205°. Estimation of the colouring matter gave $C_{15}H_{10}O_7$ = 45·45. The equation $C_{27}H_{28}O_{16} + 3H_2O = C_{15}H_{10}O_7 + 2C_6H_{12}O_6$ requires $C_{15}H_{10}O_7$ = 45·61 per cent.

The colouring matter has all the properties of quercetin, and the penta-acetyl compound, prepared in the usual manner, melted at 190° and gave on analysis :

C = 58·48 ; H = 3·93. Calc. C = 58·59 ; H = 3·90 per cent.

The glucoside is therefore identical with osyritrin.

165. "The relative influence of the ketonic and ethenoid linkings on refractive power." By Ida Smedley.

The molecular refractions of the following unsaturated ketones were determined in chloroform solution :

	M_α.	M_β.	M_γ.
Benzylideneacetone	48·52	51·33	53·79
Benzylideneacetophenone	70·48	75·30	80·2
Cinnamylideneacetone	64·19	70·76	—
Dibenzylideneacetone	84·04	92·17	—
Cinnamylideneacetophenone	87·59	98·17	—
Cinnamylidenebenzylideneacetone ...	102·69	—	—
Dicinnamylideneacetone	121·5	—	—

The conclusion is drawn that, placed at one end of a chain of conjugated ethenoid linkings, the ketonic and ethenoid linkings have apparently the same effect in exalting refractive power. When interposed in a chain of ethenoid linkings, the effect of the carbonyl group diminishes the exaltation. Its effect is probably then comparable with that of an ethenoid linking contained in a side-chain.

166. "The constitution of the β-diketones." By Ida Smedley.

The evidence from the physical properties of the β-diketones was shown to be in harmony with a hydroxy-ketonic structure, and it is found unnecessary to assume the existence of the di-enolic form. Dibenzoyldimethylmethane (m. p. 99°) was prepared, and the molecular refractions of the following substances were determined in chloroform solutions.

	M_α.	$M_\beta - M_\alpha$.
Benzoylacetone	50·3	3·2
Dibenzoylmethane	74·6	6·9
Dibenzoylethylmethane	75·0	3·4
Dibenzoyldimethylmethane	76·0	2·3
Ethoxybenzylideneacetophenone ..	79·6	5·2
Tetraphenylallene	117·7	6·7
Tetraphenylacetone	115·3	4·0

In the preparation of tetraphenylallene (Vorländer, *Ber.*, 1906, **39**, 1024), tetraphenylacetone, m. p. 28°, was isolated.

The action of the Grignard reagent on dibenzoylmethane and benzoyldimethylmethane was also studied.

167. "An apparatus for the distillation of fats and fatty acids in the vacuum of the cathode light." By [the late] James Campbell Brown.

In the course of an investigation of the constitution of various naturally-occurring fats, it became desirable to subject the fats themselves, and also the acids derived from them, to fractional distillation in a high vacuum, with a view to effecting, if possible, a separation into their constituents.

Distillations in the vacuum of the cathode light have been previously carried out, notably by Krafft (*Ber.*, 1896, **29**, 1316), but it was thought that the apparatus used might be considerably improved, more particularly in the case of the receiver.

A series of experiments was therefore entered upon with this object in view, and the apparatus described below is the outcome. It consists essentially of a desiccator, made with a broad flange, on to which the lid was very carefully ground by means of carborundum powder. Inside the lower portion of the desiccator a circular iron plate was fitted on glass bearings in such a way that it could revolve very freely. The best method of doing this was found to be as follows.

A cork, or, as was afterwards used, a block of lead carrying a pointed glass rod, was cemented to the bottom of the vessel in an exactly central position. The plate was fitted by means of a cork cemented firmly to it with a glass tube which would pass freely over the rod, and the sealed end of which rested on the point of the latter.

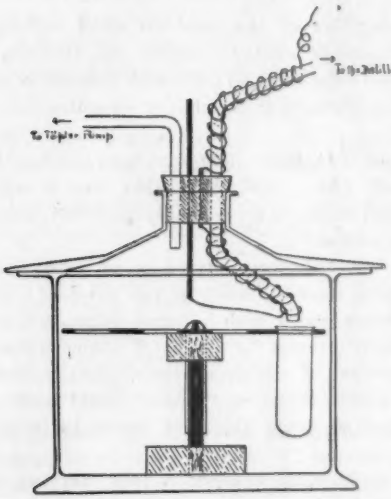
The plate was pierced near its rim with eight holes, each of which carried a test-tube, and each of these tubes could be brought in turn beneath the delivery-tube by means of a magnet worked on the outside of the vessel.

The lid of the desiccator was fitted with a tightly fitting rubber cork, through which passed the delivery-tube and the exit-tube, and also two thick brass rods, the use of which will be explained later. In the earlier experiments this cork was fitted with a mercury tube, but it was found that this was unnecessary, and that the same end could be obtained by lubricating the stopper with a small amount of glycerol. The delivery-tube was sealed to the flask which contained the substance to be distilled, whilst the exit-tube was sealed to a Töpler pump. On the exit-tube was sealed a vacuum tube, through

which the passage of an electric discharge was used to determine the vacuum.

On testing the apparatus it was found to hold a vacuum, in which the green fluorescence was visible for at least two hours, and as it was intended to keep the pump at work throughout each experiment, this was considered quite satisfactory.

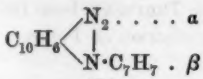
In the distillation of acids the melting point of which was in the neighbourhood of 70°, a difficulty was met with. The acid solidified in the delivery-tube inside the desiccator, and thus brought the distillation to an abrupt close. This difficulty was surmounted by wrapping the delivery-tube with resistance wire both inside and outside the receiver, and keeping the tube hot by passing a current through the wire. In order to prevent the acid from solidifying in the portion of the tube which passed through the stopper, the tube was heated for about twenty minutes before the experiment was started, and the difficulty was in this way overcome. The brass rods previously mentioned were used to convey the current through the stopper.



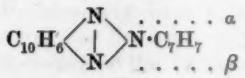
The working of the apparatus will be better understood by reference to the figure, which shows an elevation of the receiver, and a plan of the revolving plate. Many experiments were carried out with it, and in all these it worked extremely well. Its advantages are that it occupies an extremely small space, and that a distillate can readily be divided into any number of fractions, it is very easy to manipulate, while at the same time very high vacua indeed can be maintained in it over a comparatively extended period.

168. "**The *p*-tolyl-1 : 2-naphthylenediazoimines (3-*p*-tolyl-*β*-naphtha-*iso*triazoles).**" (**Preliminary note.**) **By G. T. Morgan and Arthur Bramley.**

The authors have prepared 2-p-*tolylnaphthylene*-1-*diazo*-2-*imine* (3-p-*tolyl*-*β*-*naphtha*isotriazole) (I), m. p. 165—166°, by the action of nitrous acid on 2-*p*-tolyl-1 : 2-naphthylenediamine, and its isomeride, 2-*p*-tolyl-1 : 2-naphthatriazole (II), m. p. 149°; the latter substance was obtained by oxidising *p*-tolueneazo-*β*-naphthylamine (m. p. 113°) with chromic acid, and corresponds in properties with the product recently isolated by G. Charrier on heating the foregoing azo-*β* naphthylamine at 300° (*Atti R. Accad. Sci. Torino*, 1910, **45**, 131).



(I.)



(II.)

The authors propose to examine the physical and chemical properties of other members of the two series of triazenes indicated by the above formulæ.

169. "**A note on the aromatic derivatives of antimony.**" **By G. T. Morgan, F. M. G. Micklethwait, and G. S. Whitby.**

In pursuing the investigation of certain derivatives of triphenylstibine oxide recently described (*Trans.*, 1910, **97**, 34), the authors have found that the nitration of triphenylstibine leads to the formation of a *nitro*-derivative, melting at 190°, from which, by reduction, a diazotisable *amine* can be obtained. Some of the acyl derivatives of this base have been prepared.

By the nitration of triphenylstibine hydroxynitrate, a *trinitro*-compound is produced, which on reduction yields a crystallisable *triamine*, furnishing a crystalline *hydrochloride*. This base has also given *acetyl* and *azo-β-naphthol* derivatives, together with *platini-* and *stanni-chlorides*.

The sulphonation of triphenylstibine and triphenylstibine hydroxysulphate has been undertaken, and a soluble *trisulphonic acid* obtained, yielding very soluble alkali salts.

The authors are at present engaged in the further study of these and other derivatives of triphenylstibine.

LIST OF FELLOWS, 1910.

The List of Fellows for 1910 is now in active preparation, and changes of address received after 30th June cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

At the next Ordinary Scientific Meeting on **Thursday, June 16th**, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Studies of dynamic isomerism. Part XII. The equations for two consecutive unimolecular changes." By T. M. Lowry and W. T. John.

"Studies of dynamic isomerism. Part XIII. Camphorcarboxyamide and camphorcarboxypiperidide." By W. H. Glover and T. M. Lowry.

"The constitution of orthodiazoimines. Part I. The naphthylenediazoimines and their benzenesulphonyl derivatives." By G. T. Morgan and W. Godden.

"The colour and constitution of diazonium salts. Part II. Diazoderivatives of *as*-benzylethyl-1 : 4-naphthylenediamine." By G. T. Morgan and E. G. Couzens.

"The action of alkalis on certain derivatives of coumarin." By A. Clayton.

"The colour and constitution of the amino-coumarins." By A. Clayton.

"The relation between absorption spectra and chemical constitution. Part XV. The nitrated azo-compounds." By E. C. C. Baly, W. B. Tuck, and Miss E. G. Marsden.

"Indirubin. Part I." By W. P. Bloxam and A. G. Perkin.

"Estimation of sodium and cæsium as bismuth nitrites. Part I. Estimation of sodium." By W. C. Ball.

"The by-products of alcoholic fermentation." By Miss C. E. Ashdown and J. T. Hewitt.

"A simple method of preparing tetranitromethane." By F. D. Chattaway.

"Dimethoxy-*p*-tolylphenylmethane." By J. E. Mackenzie.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 16th, 1910.

Batley, Ward Allen,
197, Eccles New Road, Salford, Manchester.
Science Lecturer. B.Sc. (Chemistry and Physics) Manchester University, 1908. M.Sc. (Chemistry) 1909. Wishful to keep abreast with chemical research.

Harold B. Dixon.	Alfred Holt, jun.
W. H. Perkin.	Ch. Weizmann.
Norman Smith.	*Arthur Lapworth.*

Bracewell, Geoffrey Alfred,
20, Heaton Grove, Bradford.
Analytical and Consulting Chemist. For one year at Leeds University (Science Dept.). For three years with F. W. Richardson, Esq., F.I.C. Joint Author with F. W. Richardson, Esq.: "Factors in the Analysis of Beeswax, Woolgrease," etc., Soc. Chem. Industry. Fellow of the Royal Microscopical Society.

F. W. Richardson.	F. W. Branson.
A. Jaffé.	B. A. Burrell.

George H. Martin.

Collett, Ronald Leslie,
Little Dawley, Hayes, Middlesex.
Analytical Chemist. B.A. (Cantab.) Natural Science Tripos. Associate of the Institute of Chemistry.

Bernard Dyer.	Herbert Jackson.
John M. Thomson.	Patrick H. Kirkaldy.

Alf. Chaston Chapman.

Dand, Middleton Henry,

Steyning, Sussex.

Brewer. Have spent many years in the study and practice of Chemistry as applied to the brewing industry, and am the inventor of the "Dand Forcing Tray Flask" and the "Lawrence-Dand Refrigerators."

Basil Wm. Valentin.	F. G. Adair Roberts.
Francis Davidson.	*B. E. R. Newlands.*
A. J. Murphy.	*John Joseph Eastick.*

Dodd, Alexander Scott,

173, Bruntsfield Place, Edinburgh.

Analytical Chemist. (1) Six and a half years' experience in Analytical Chemistry under J. Falconer King, Esq., F.I.C., City Analyst of Edinburgh. (2) Associate of the Institute of Chemistry. (3) B.Sc. Final in Chemistry on the Higher Standard at Edinburgh University.

J. Falconer King.	Leonard Dobbin.
John E. Mackenzie.	J. P. Longstaff.
James Walker.	Alex. C. Cumming.

Grieve, James,

127, Buchanan Street, Glasgow.

Chemist. Pharmaceutical Chemist; Member of the Pharmaceutical Society; Lecturer on Pharmacy and Materia Medica at the Glasgow and West of Scotland Technical College; a Director of Frazer and Green, Ltd., Manufacturing Chemists, Glasgow.

Martin Dechan.	*Arthur W. Crossley.*
W. H. Martindale.	*Chas. Horne Warner.*
Alex. Gunn.	*Charles Alex. Hill.*
W. L. Howie.	*Charles Gilling.*
C. R. Hennings.	*Thomas Cockburn.*

Guhlmann, Charles Frederick,

Grantwood, Bergen Co., New Jersey, U.S.A.

Chief Chemist, General Chemical Company of New York, "Hudson River Works," U.S.A. University of Pennsylvania, Mining Engineering and Chemistry Class, 1896. From 1896 to 1906, Chief Chemist, Harrison Bros. & Co., Chemical Wks., Philadelphia. From 1906 up to and including present time, Chief Chemist, Gen. Chem. Co.,

Hudson River Works. Inorganic and Organic Research in Manufacturing and Analytical Chemistry.

T. Lynton Briggs. Hardee Chambliss.
G. T. Bruckmann. *Charles F. Chandler.*
Marston T. Bogert.

Hackford, John Edward,
15, Burford Road, Nottingham.

Chemist to the Russian Steam Oilmill Co., St. Petersburg. B.Sc. 2nd Class Honours (Lond.). A.I.C. Joint author of: (1) "The Electrolytical Estimation of Minute Quantities of Arsenic," Sand & Hackford, (*J.C.S.*, 1904, p. 1018), and (2) "The Preparation of Silicols from Silicones, and their Spontaneous Transformation into Oxides," Kipping & Hackford (to be published shortly).

R. M. Caven. F. Stanley Kipping.
Henry J. S. Sand. Arthur Slator.
G. Druce Lander.

Haycock, John,
Great Glen, near Leicester.

Analytical Chemist. Pharmaceutical Chemist. Chief Chemist to Messrs. T. H. Lloyd & Co., Leicester At present engaged on elaborating a new method for the separation and estimation of Cinchona alkaloids. Wishes to keep in contact with current chemical knowledge.

Edward Masters. S. F. Burford.
C. T. Bennett. *Ernest J. Parry.*
H. D. Law.

Huck, John,
The Foundation, St. Bees School, Cumberland.

Schoolmaster. Senior Science Master St. Bees School. M.A. Cantab. 1st Class Natural Science Tripos, Pt. I., 1904. Scholar and Prizeman, Selwyn College, Cambridge. Science Master and Lecturer: Berkhamsted School, Herts (2 years); St. Bees School, Cumberland (4 years).

George Dixon. C. T. Heycock.
John Parkin. R. H. Adie.
L. A. Borradaile. C. H. H. Walker.
Robert Hellon.

Jacobs, Lionel Leslie,
Shelford, Beckenham, Kent.

Assistant Manager. Dominion Tar and Chemical Co.'s Works, Sault Ste. Marie, Ont. Student of Chemistry studying for degree.

Some knowledge and technical experience of Coal Tar Products. Shortly to assist in research work in Coal Tar Products.

George Barger. Geo. Jas. Woods.
Reginald W. L. Clarke. Elkan Wechsler.
Isaac S. Scarf.

Joshi, Govind Laxman,
5, Argyle Avenue, Victoria Park, Manchester.

Govt. of India State Technical Scholar. L. T. M. (Bombay), the course of study being Textile Chemistry, Physics, Mathematics and Engineering. Studied Applied Chemistry at the Muncipal School of Technology and I am desirous of keeping in touch with the latest researches in Chemistry.

Jas. Grant. F. S. Sinnatt.
F. G. Richards. S. J. Peachey.
E. L. Rhead.

Long, Frank Stevenson,
"Hadley," 80, Tylney Road, Forest Gate.

Demonstrator, Chemical Dept., East London College. B.Sc. (Lond.). At present engaged in research.

J. T. Hewitt. S. H. Woolhouse.
F. G. Pope. Clarence Smith.
J. J. Fox.

Martin, William Ernest,
111, Bellevue Rd., Berea, Durban, Natal.

Explosives Chemist. Chief Chemist, Kynoch Ltd., Umboputurin, Durban. Seven years Assistant, Government Laboratory, Waltham Abbey, Essex. Four years Chemist in charge of Guncotton Factory, Kynoch, Ltd. Seven years Chief Chemist, Kynoch, Ltd., Arklow.

Walter H. Pay. J. S. Jamieson.
H. H. C. Puntan. *E. Nevill.*
A. B. Tonkin.

Narbeth, Benjamin Mason,
Durban Technical Institute.

Principal of the Durban Technical Institute. Bachelor of Science in the University of Wales. Formerly Lecturer at the Swindon and North Wilts Technical Institute. Studied Chemistry at St. John's College, Battersea, and at University College, Cardiff.

J. S. Jamieson. A. B. Tonkin.
E. Nevill. *H. H. C. Puntan.*
Walter H. Pay.

Oakley, Robert O'Field,
54, Sydney Rd., Hornsey, N.

Student of Gray's Inn; Civil Servant. London Matriculation, 1903, 1st class; Int. B.Sc., 1904, 1st class; National Scholarship in Chemistry, 1905; parts I. and II. in Chemistry at the Royal College of Science, 1905–7, 1st class; took B.Sc. Honours course with Dr. W. H. Mills at the Northern Polytechnic, 1908–9.

M. O. Forster. James C. Philip.
G. T. Morgan. E. G. Couzens.
William A. Tilden. A. Clayton.

Paris, Edward Talbot,
15, Montpellier Villas, Cheltenham.

Lecturer in Chemistry, Cheltenham Technical Schools. Lecturer to Science and Technical Students and Teachers; holds advance certificates in Chemistry; Hon. Assist. Sec. to the Cotteswold Nat. F. C.; Author of several palæontological communications; engaged in Chemico-geological research work.

J. M. Collett. Gerald T. Moody.
G. W. Headley. *Frank Dixon.*
Alfred C. Youngs.

Reddie, John Alexander,
3, Spring Gardens, Bradford, Yorks.

Chemical-Bacteriological Assistant to the Sewage Committee of the Bradford Corporation for the last 7 years. Constantly engaged in research work at the Bradford Sewage Works, and have recently isolated the Anthrax bacillus, and other specific organisms, from the Sewage of Bradford.

F. W. Richardson. Walter M. Gardner.
A. Jaffé. Barker North.
George H. Martin.

Reed, Walter William, M.Sc. (Wales), A.I.C.,
28, South Parade, Huddersfield.

Assistant Lecturer in Chemistry, Technical College, Huddersfield. First Class Hons. in Chemistry B.Sc. (Wales), June, 1906. Isaac Roberts Research Scholar, University College of North Wales, Bangor, 1906–8. M.Sc. (Wales), June, 1908. Associate of the Institute of Chemistry, April, 1908. Joint Author with Prof. K. J. P. Orton, of "The Wandering of Bromine in the Chlorination of Bromoanilines" (*Trans.*, 1907, **91**, 1543), and "Isomeric Change in Benzene Deriv-

atives. Replacement of Halogen by Hydroxyl in Chlorobromodiazobenzenes" (*Trans.*, 1907, **91**, 1554).

Kennedy J. P. Orton. Alexander Lauder.
James J. Dobbie. James Bruce.
Allan Baguley.

Rose, John George,

Government Analytical Laboratory, Cape Town, Cape Colony.

Government Analyst. Has occupied his present position of Analyst in the Government Analytical Laboratory, Department of Agriculture, Cape Colony, for the last thirteen years, i.e., since March 14th, 1897; vide "Official Chemical Appointments," 3rd edition.

J. Muller. George N. Blackshaw.
E. V. Flack. Walter D. Severn.
Arthur Stead.

Sinclair, St. Clair Overbeck, M.A.,

Government Analytical Laboratory, Grahamstown, Cape Colony.

Government Analyst. Has occupied his present position of Analyst in the Government Analytical Laboratory, Department of Agriculture, Cape Colony, for the last thirteen years, i.e., since August 5th, 1897; vide "Official Chemical Appointments," 3rd edition.

J. Muller. George N. Blackshaw.
E. V. Flack. Walter D. Severn.
Arthur Stead.

Slade, Roland Edgar,

Muspratt Laboratory, The University, Liverpool.

Assistant Lecturer and Demonstrator in Physical Chemistry. B.Sc. Honours in Chemistry (Victoria), 1906. Mercer Scholar. M.Sc. (Victoria), 1907. 1907–8, Assistant Chemist to British Aluminium Co., Ltd. 1908, Gartside Scholar. 1909, Assistant Lecturer in Physical Chemistry at Liverpool University. Publications: "The Reducibility of Magnesium Oxide by Carbon" (*Trans.*, 1908, **94**, 327).

F. G. Donnan. Ch. Weizmann.
V. J. Harding. R. Robinson.
W. H. Perkin.

Smith, James Harry,

5, Turks Road, Radcliffe, Lancs.

Chemist. Conduct Analyses. Member of the Pharmaceutical Society. Desirous of keeping in touch with recent developments of Chemistry.

J. Rymer Young. James S. Broome.
George Clayton. Wm. Scholes.
F. Smith. *James Ashton.*

Smith, Thomas May,

"Walla Crag," Osborne Road, Romford.

Trade Manager, A. Boake Roberts & Co., Ltd., Stratford, E. Has been engaged in Practical Brewing for upwards of twenty years; has had a large number of pupils through his hands; has contributed largely to the brewing literature and obtained first prize for the best Article on "Practical Brewing," in the Technical Journal, Feb., 1905.

Basil P. Wigan.	*A. Leonard H. Garside.*
Alex. K. Miller.	*Basil Wm. Valentin.*
A. Boake.	*J. Ross Mackenzie.*

Stedman, Ernest,

6, Breakwater Road, Bude, Cornwall.

Science Master. Victoria University, B.Sc. with Second Class Honours in Chemistry, 1908. Teacher of Science in Bude County School. Am desirous of keeping in touch with chemical publications.

Harold B. Dixon.	Ch. Weizmann.
W. H. Perkin.	Robert Robinson.
Norman Smith.	V. J. Harding.

Thole, Ferdinand Bernard,

23, Cowper Avenue, East Ham, Essex.

Assistant Lecturer, East Ham Technical College. B.Sc. (Lond.), 1st Class Honours Chemistry. Published research with Prof. Hewitt on "Colour and Constitution of Azo-Compounds," and with Mr. Dunstan on "The Relation between Viscosity and Chemical Constitution."

W. H. Barker.	J. T. Hewitt.
F. G. Pope.	Albert E. Dunstan.

W. T. Clough.

Williams, Frederick George,

5, Mayhill Road, Charlton, S.E.

Metallurgist. For seven years First Assistant to the Metallurgist, Royal Gun Factories, Royal Arsenal, Woolwich. Training in Chemistry and Metallurgy at the Birkbeck College, Chancery Lane, London.

Wesley Lambert.	R. J. Redding.
A. H. Mundey.	H. Russell Pitt.

H. Heron Smith.

The following Certificates have been authorised for presentation to Ballot by the Council, under Bye-law I (3):

Sorabji, Kaikhushroo Bamanji,
Secunderabad, Deccan, India.

Graduate in Medicine and Surgery of the Bombay University. Engaged in Chemical Analysis. The object is to be always well-informed of the latest researches in Chemical Science.

E. M. Modi.

Williams, John,
122, Liddell Street, Invercargill, New Zealand.

Trained Teacher. Chemistry Master, Southland Boys' High School, Invercargill, and Technical School, Invercargill, since Sept. 1907. (1) Bachelor of Science, London, in Chemistry, Physics and Mathematics. Bachelor of Science, New Zealand. (2) Triple Honours in Chemistry, Board of Education. (3) Teacher of Theoretical and Practical Chemistry in the Technical School, Brierley Hill.

Wm. Whitehouse. Frank E. Thompson.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C. AND BUNGAY, SUFFOLK.

Issued 29/6/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 374.

Thursday, June 16th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. A. Clayton, Frederick C. Lewis, and Charles Proud were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Henry Vincent Aird Briscoe, B.Sc., 33, Bargery Road, Catford, S.E.

David Jackson MacGeorge, Rangoon Refinery Co., Ltd., Thilawa, Burma.

Alec Duncan Mitchell, B.Sc., Carnock, Hartley Road, Leytonstone, N.E.

William James Pittock Smith, 9, Meddowcroft Road, Gerard Road, Wallasey.

Claude Vareille Temperley, B.Sc., Trent College.

Richard Babington Turbutt, B.A., Royal Artillery Mess, Woolwich.

Herbert Goulding Williams, B.Sc., Robert Gordon's College, Aberdeen.

William Norman Stewart Wright, 26, Lansdowne Crescent, Glasgow, W.

A Certificate has been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of:

Professor Leo Tschugaeff, The University, St. Petersburg.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected :

Ward Allen Batley, M.Sc.
Geoffrey Alfred Bracewell.
Ronald Leslie Collett, B.A.
Middleton Henry Dand.
Alexander Scott Dodd, B.Sc.
James Grieve.
Charles Frederick Guhlmann.
John Edward Hackford, B.Sc.
John Haycock.
John Huck, M.A.
Lionel Leslie Jacobs.
Govind Laxman Joshi.
Frank Stevenson Long, B.Sc.
William Ernest Martin.
Benjamin Mason Narbeth, B.Sc.
Robert O'Field Oakley.
Edward Talbot Paris.
John Alexander Reddie.
Walter William Reed, M.Sc.
John George Rose.
St. Clair Overbeck Sinclair, M.A.
Roland Edgar Slade, M.Sc.
James Harry Smith.
Thomas May Smith.
Kaikhushroo Bamanji Sorabji.
Ernest Stedman, B.Sc.
Ferdinand Bernard Thole, B.Sc.
Frederick George Williams.
John Williams, B.Sc.

Of the following papers, those marked * were read:

***170. "Studies of dynamic isomerism. Part XII. The equations for two consecutive unimolecular changes." By Thomas Martin Lowry and William Thomas John.**

The problem considered is that of a reversible isomeric change of the type $A \rightleftarrows B \rightleftarrows C$, in which the intermediate compound, B, is formed in quantities comparable with those of the initial material, A, and the final product, C. Equations are deduced for the changes of concentration with time in the case of each of the three substances: (*a*) when the sum of the concentrations is constant, as in an ordinary "mutarotation" experiment, and (*b*) when the concentration of the initial material is kept constant, for example, by saturation with the solid. The curve connecting concentration with time in the case of the compound C is inflected in character, the position of the point of inflexion depending on the four velocity constants corresponding with the four arrows of the above equation. Curves, showing the point of inflexion and the tangent at this point, have been drawn for a number of typical cases.

***171. "Studies of dynamic isomerism. Part XIII. Camphorcarboxyamide and camphorcarboxypiperidide." By Walter Hamis Glover and Thomas Martin Lowry.**

Camphorcarboxyamide, $C_8H_{14}<\begin{matrix}CH\cdot CO\cdot NH_2\\ CO\end{matrix}$, prepared by heating the methyl ester with aqueous ammonia in a sealed tube at 100°,

crystallises well from benzene, heptane, or light petroleum, melts at 118°, and gives an indigo coloration with ferric chloride. Changes of rotatory power are observed in freshly-prepared solutions of the amide in heptane, benzene, and alcohol. The solubility in heptane at 20° shows an analogous change, from 0·38 to 0·80 per cent., in the course of the first hour or two after the solvent is added, indicating that the initial material forms about 48 per cent. of the final product.

The *bromoamide*, $C_8H_{14}\begin{cases}CBr\cdot CO\cdot NH_2\\ CO\end{cases}$, melts at 114°, and gives no coloration with ferric chloride.

The *piperidide*, $C_8H_{14}\begin{cases}CH\cdot CO\cdot NC_5H_{10}\\ CO\end{cases}$, prepared by the action of piperidine on the ester, melts at 106°, and gives a greenish coloration with ferric chloride. Changes of rotatory power are observed in freshly-prepared solutions in heptane, benzene, and alcohol, but the mutarotation curves do not obey the unimolecular law, and the curves for solutions in benzene are strongly inflected; the abnormal character of the curves is attributed to the occurrence of two consecutive isomeric changes. The solubility in heptane increases from 2·06 to 4·66 per cent., and the proportion of the initial material in the final product is taken to be about 44 per cent.

The *bromo-piperidide*, $C_8H_{14}\begin{cases}CBr\cdot CO\cdot NC_5H_{10}\\ CO\end{cases}$, melts at 132°, gives no coloration with ferric chloride, and undergoes no changes of rotatory power in freshly-prepared solutions.

Discussion.

Mr. Baly asked what evidence Dr. Lowry had that the compounds described exist in the enolic form. It appeared to him that the results described by Dr. Lowry in his last two papers (*Trans.*, 1910, 97, 899 and 905) were capable of another explanation, and that the existence of the enolic form was not proved by the spectroscopic observations. Of course these remarks did not influence in any way the value of the curves under discussion, but Mr. Baly questioned the advisability of assuming the existence of the enolic modifications if this assumption were only based upon the spectroscopic observations described in the previous work.

Dr. Senter asked, in reference to the observations on initial retardation, with what vessels the optically active substances had been in contact during the experiments.

In reply to Mr. Baly, Dr. Lowry said that in order to account for the inflected mutarotation curves it was only necessary to assume two successive isomeric changes in compounds of approximately equal

stability. The intermediate compound was probably enolic, but this was not essential. In reply to Dr. Senter, both glass and silica tubes had been used; the velocities of isomeric change varied considerably, but the general form of the curves was the same for high and for low velocities.

*172. "A simple method of preparing tetranitromethane." By Frederick Daniel Chattaway.

Tetranitromethane in nearly theoretical amount can be obtained, if a suitable procedure be adopted, by the interaction of nitric acid and acetic anhydride.

The action of nitric acid on acetic anhydride has been described as dangerously violent. This, however, is not the case unless the temperature at which they are brought together is unnecessarily high.

When nitric acid attacks acetic anhydride a mononitro-derivative is probably first produced, which is so much more readily nitrated than the parent compound that action proceeds until the three hydrogen atoms of a methyl group have been replaced. The trinitroacetic acid formed by hydrolysis then slowly decomposes into carbon dioxide and nitroform, which is converted as soon as it is liberated into tetranitromethane.

The methods adopted in preparing, isolating, and purifying tetranitromethane were described.

The necessary operations are so simple and so easily carried out that the preparation is well adapted to take its place in any elementary course of practical organic chemistry to illustrate the ease with which aliphatic compounds can be nitrated, whilst the materials employed are so cheap and the yield is so satisfactory as to make tetranitromethane, which has hitherto been a somewhat unfamiliar substance, one of the most easily procurable of organic compounds.

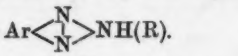
Discussion.

The President asked whether Dr. Chattaway had any proof of the formation of nitroform.

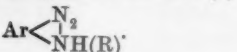
Dr. Chattaway said that he had no proof that nitroform was actually liberated as an intermediate product, but its formation appeared to be a necessary step in the series of reactions which must be assumed to take place. The conditions of interaction were such that it would be difficult, if not impossible, to recognise it as an intermediate product, since, in small amount, it was formed by the action of water on tetranitromethane.

*173. "**The constitution of ortho-diazoimines. Part I. The naphthylenediazoimines and their benzenesulphonyl derivatives.**" By **Gilbert T. Morgan and William Godden.**

The authors' experiments had for their object the determination of the constitution of the ortho-diazoimines produced by the action of nitrous acid on the ortho-diamines. If the ortho-diazoimines and their acyl derivatives are to be represented by the general formula (I),

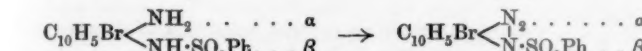


(I.)



(II.)

then 1-*benzenesulphonyl*-4-*bromo*-1:2-*naphthylenediamine* (III) (m. p. 220°) and its isomeride, 2-*benzenesulphonyl*-4-*bromo*-1:2-*naphthylenediamine* (V) (m. p. 171°), should yield the same diazoimide; but on treatment with nitrous acid they give rise respectively to the isomeric compounds, 1-*benzenesulphonyl*-4-*bromonaphthylene*-2-*diazo*-1-*imide* (IV) (m. p. 159°) and 2-*benzenesulphonyl*-4-*bromonaphthylene*-1-*diazo*-2-*imide* (VI) (m. p. 209°).



(III.) (IV.)

(V.) (VI.)

These results indicate that the ortho-diazoimines and their acyl derivatives are more correctly represented by the general formula (II).

Further confirmation was obtained by a study of the diazoimino-derivatives of 1:2- and 2:3-naphthylenediamines.

*174. "**The colour and constitution of diazonium salts. Part II. Diazo-derivatives of *as*-benzoylethyl-1:4-naphthylenediamine.**" By **Gilbert T. Morgan and Edward G. Couzens.**

as-*Benzoylethyl*-1:4-*naphthylenediamine*,

$$NH_2 \cdot C_{10}H_6 \cdot N(C_2H_5) \cdot CO \cdot C_6H_5,$$

contains an ethyl group in the place of the more labile hydrogen atom of benzoyl-1:4-naphthylenediamine, $NH_2 \cdot C_{10}H_6 \cdot \overset{*}{N}H \cdot CO \cdot C_6H_5$, yet both these bases give rise to yellow diazonium salts of considerable stability.

It follows that the colour of these diazo-derivatives is not due to any departure from the normal diazonium type consequent on a migration of hydrogen.

In the benzene series, the corresponding diazonium salts of benzoyl-*p*-phenylenediamine and the *as*-benzoylalkyl-*p*-phenylenediamines, although exceptionally stable, are colourless (*Trans.*, 1909, **95**, 1319).

The appearance of colour among aromatic diazonium salts is due, not to changes in the diazo-residue, but to an increase in the complexity of the aromatic nucleus with which this group is associated.

DISCUSSION.

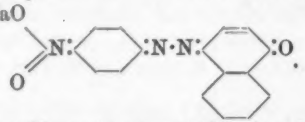
Dr. HEWITT stated that in view of the work just described, he fully accepted Dr. Morgan's conclusion that the *p*-acylaminodiazonium salts did not differ constitutionally from other diazonium salts.

***175. "The action of alkalis on certain derivatives of coumarin." By Arthur Clayton.**

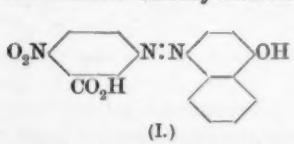
The action of alkalis on a number of nitro-derivatives of coumarin and its homologues has been investigated. Coumarins with a nitro-group in position 3 are converted by alkalis into the corresponding salicylaldehydes. If a methyl group is also present in position 4, a ω-nitro-α-methylstyrene is formed. Two new coumarinic acids have been isolated.

***176. "The relation between absorption spectra and chemical constitution. Part XV. The nitrated azo-compounds." By Edward Charles Cyril Baly, William Bradshaw Tuck, and Effie Gwendoline Marsden.**

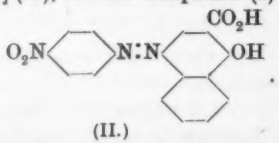
Hewitt and Mitchell (*Trans.*, 1907, **91**, 1251) dealt with the ortho- and para-nitrobenzeneazophenols and nitrobenzeneazo-α-naphthols, and from the change in colour produced on the addition of alkali hydroxides concluded that the sodium and potassium salts have the di-quinonoid structure, as, for example:



They also brought forward evidence to support this, based upon the two isomeric carboxy-derivatives (I) and (II), for the compound (I)



(I.)



(II.)

gives a blue lake with lead acetate, whilst (II) gives a red one.

It has now been shown from a comparison of the nitrobenzeneazophenols and their sodium salts with the corresponding nitrobenzeneazodimethylanilines, benzeneazophenol and its sodium salt, and with *p*-benzoquinoneazine, that the quinonoid explanation is incorrect. It is found that the carboxylic acids (I) and (II), as well as two other isomeric compounds which cannot possess two adjacent hydroxyl groups, give colloidal sodium salts. The solutions of these salts are precipitated by any metallic salt, as, for example, sodium chloride; the colour of these precipitates varies with the concentration, so that no conclusion whatever can be drawn as to two adjacent hydroxyl groups from the formation of insoluble precipitates with lead acetate.

Discussion.

Dr. Hewitt dissented from Mr. Baly's view as to the constitution of the salts of *p*-nitrobenzeneazo-α-naphthol and allied compounds. Benzeneazo-α-naphthol gave an alcoholic solution which, if sufficiently dilute, was yellow, and the colour was altered to a comparatively slight extent by the addition of alkali. Substitution derivatives of the type: $p\text{-}X\cdot C_6H_4\cdot N{:}N\cdot C_{10}H_6\cdot OH$ behaved in a similar manner, where $X = Cl$, CO_2Na, SO_3Na, etc.; but where $X = NO_2$, $CH_3\cdot CO\cdot$ or $H\cdot CO\cdot$, then addition of alkali produced a far larger displacement of the band of least frequency, with the result that purple or blue solutions were obtained. The first class of substituents did not allow of a quinonoid structure for the alkali salts, but this was possible with substituents of the second class. Another remarkable example was afforded by *p*-nitrobenzeneazosalicylaldehyde, t..e yellow alcoholic solution of which was but slightly affected on rendering alkaline; this was probably owing to salt formation taking place with quinonoid rearrangement involving the aldehydo-group, so inhibiting the azobenzenequinone structure. Additional support was lent to this view by the fact that if the aldehydo-group was put out of action by conversion into a phenylhydrazone, addition of alkali produced an intense purple coloration.

Chemical properties were, however, far more important than optical in deciding questions of structure, and the observation made many years ago by Meldola, that *p*-nitro-substituted azophenols could be reduced smoothly to the corresponding amino-compounds by hydrogen sulphide in ammoniacal solution, showed that the ammonium salts of these *p*-nitro-compound possessed a different structure from the unsubstituted parent substances with the true azo-linking, since the latter underwent fission at the double linking between the nitrogen atoms.

In reply to Dr. Hewitt, Mr. Baly drew attention to an interesting fact about the blue alkaline solution of *p*-nitrobenzeneazo-α-naphthol.

In thin layers the solution was blue by transmitted light, but in thick layers it was pure red. This observation showed the danger of arguing entirely from visual colour. It appeared to him that Dr. Forster had drawn attention to the most important point, for the shifts observed on the addition of alkali to *o*-, *m*-, and *p*-nitrobenzeneazo-phenols and -α-naphthols were all very similar; indeed, *m*-nitrobenzeneazo-α-naphthol gave a greater shift than the *o*- and *p*-isomerides. Moreover, the shift given by benzeneazophenol was the same as that of the nitro-derivatives.

*177. "Indirubin. Part I."

By William Popplewell Bloxam and Arthur George Perkin.

In order to study the conditions necessary for the formation of indirubin by the air-oxidation of indoxyl, the authors have devised a method for the quantitative estimation of the former colouring matter in indigo. The dyestuff mixed with purified sand is introduced into a glass tube (25 × 90 mm. approx.) closed at one end with calico, which is placed in a Soxhlet apparatus and the material extracted with pyridine. The pyridine extract is evaporated finally with the addition of hot water, and the precipitate, which consists of indirubin and a little indigotin together with impurities, is collected on asbestos, washed with dilute hydrochloric acid to remove mineral matter, with 1 per cent. alkali to dissolve indigo-brown, and finally with 1 per cent. acetic acid solution. The crystalline residue is dried, sulphonated, and the solution of the mixed sulphonic acids analysed by means of the Duboscq colorimeter.

The residual mixture of sand and crude indigotin is washed in the Soxhlet apparatus with hot 10 per cent. sulphuric acid, which removes indigo gluten and some mineral matter, and with water until free from acid; the residue is then dried and sulphonated in the ordinary manner, the product dissolved in water, the solution filtered, and titrated with permanganate or titanium trichloride. The accuracy of the process has been determined by an examination of mixtures of pure indigotin and indirubin, and the reliability of the colorimetric work, in respect of the amount of colouring matter present, by means of titanium chloride. The authors have also analysed certain special varieties of Java indigo and other indigos, and it was further pointed out that by this pyridine method a quantitative determination of indigo-brown is also possible.

Discussion.

Mr. A. G. Perkin said that although the fact that dilute solutions of the indigotinsulphonic acids were decolorised by less permanganate

than that required for the isatin reaction had been known for some time, the matter had not as yet been investigated. It was therefore apparent that the oxidation took place in two stages, and there was some possibility that the sulphonic acid of Kalb's (*Ber.*, 1909, **42**, 3642) dehydroindigotin might be produced in this manner. More striking in this respect were the sulphonic acids of indirubin, because under similar conditions the quantity of permanganate necessary for decolorisation was approximately only 75 per cent. of that calculated on the isatin equation. The primary product in the latter case was thus fairly stable in the presence of the oxidising agent, and attempts were being made to isolate it in the unsulphonated condition by the oxidation of indirubin itself.

178. "The colour and constitution of the amino-coumarins." By Arthur Clayton.

The colour of the amino-derivatives of coumarin and its homologues was shown to be independent of the position of the amino-group, and not to be due to the presence of a mobile hydrogen atom. The suggestion was made that the colour is generated by the continual breaking and reforming of valency bonds between the amino-group and the unsaturated ·O·CO· group present in the lactonic ring.

179. "Estimation of sodium and cæsium as bismuthi-nitrites. Part I. Estimation of sodium." By Walter Craven Ball.

Sodium may be estimated, even in the presence of a very large excess of potassium, by precipitation as sodium cæsium bismuthi-nitrite (*Trans.*, 1909, **95**, 2126). The precipitation is conducted in a special form of vessel, and the precipitate dried at 100° and weighed. The sodium present in complex mixtures, such as sea-water, may thus be estimated.

180. "The by-products of alcoholic fermentation." By Olive Eveline Ashdown and John Theodore Hewitt.

Alcohol as obtained by the fermentation of dextrose or dextrose-yielding materials by yeast contains numerous by-products. In certain cases these may be referred to substances other than dextrose, but acetic acid is probably furnished by the oxidation of acetaldehyde, which, in turn, is certainly derived from dextrose, since it is produced when pure specimens of this sugar are fermented in the presence of suitable nourishment, no other organic material being added.

The idea that the quantity of aldehyde might depend on the avail-

able nitrogen proved unfounded; incidentally, support is afforded to Ehrlich's view as to the source of the higher alcohols by the observation that addition of alanine diminishes the amount of these substances.

The amount of aldehyde may be diminished by the addition of small amounts of formates, a result of considerable interest in view of the statement of Schade (*Zeitsch. physikal. Chem.*, 1906, **57**, 1; 1907, **60**, 510) that dextrose yields acetaldehyde and a formate under the influence of alkali, whilst acetaldehyde and formic acid yield ethyl alcohol and carbon dioxide with rhodium sponge as a catalyst.

181. "Dimethoxyphenyl-*p*-tolylmethane." (Preliminary note.)

By John Edwin Mackenzie.

In previous communications (*Trans.*, 1896, **69**, 985; 1901, **79**, 1204; 1904, **85**, 790; (Clough) 1906, **89**, 771) the author and his collaborators have described the products formed by the interaction of benzophenone chloride and of benzylidene chloride on the sodium compounds of various alcohols and phenols.

It was thought that from phenyl *p*-tolyl ketone chloride a series of derivatives might be obtained according to the general equation:

$$C_6H_4Me\cdot CCl_2\cdot C_6H_5 + 2NaOR = C_6H_4Me\cdot C(OR)_2\cdot C_6H_5 + 2NaCl,$$

where R represents an alkyl group. A comparison of the physical properties of such compounds with those of the corresponding derivatives already obtained from benzophenone chloride and those to be obtained from ditolyl ketone chloride should prove interesting as showing the influence of the methyl group as a substituent of hydrogen in various positions.

Phenyl *p*-tolyl ketone was prepared by the action of benzoyl chloride on a large excess of toluene in presence of aluminium chloride according to Bourget's method (*Bull. Soc. chim.*, 1896, [iii], **15**, 945). The ketone distilled between 184° and 191°/20 mm., and crystallised out on cooling. By recrystallisation from alcohol, colourless crystals melting at 56—57° were obtained, the weight of crystals being 43 per cent. of that theoretically obtainable.

The dichloride is formed by the action of phosphorus pentachloride on the ketone: $CH_3\cdot C_6H_4\cdot COPh + PCl_5 = CH_3\cdot C_6H_4\cdot CCl_2Ph + POCl_3$. Overton (*Ber.*, 1893, **26**, 26) appears to have obtained the crude chloride. As it decomposes very readily on heating, the following method of preparation was adopted. To the ketone dissolved in ten times its weight of carbon tetrachloride, the equivalent weight of phosphorus pentachloride was added, and the mixture was then heated in a water-bath for four hours. The solvent was distilled off under 25 mm. pressure, the temperature being eventually raised to 85°.

The residual dark green oil had a strong odour of hydrogen chloride, and was very unstable in presence of water, being reconverted into the ketone.

Determinations of chlorine made at the stated intervals gave the following percentages: after one day 27·4 (theory 28·28), five days 15·35, ten days 7·8, eleven days 5·4, and on the thirteenth day crystals of the ketone separated out.

Dimethoxy-p-tolylphenylmethane was prepared by mixing the chloride with an equivalent weight of sodium methoxide in ten times its weight of methyl alcohol. A vigorous reaction took place. After filtering off the salt, the alcohol was distilled off under diminished pressure, and the residue extracted several times with ether. This ethereal solution was dried, the ether distilled off under the ordinary pressure, and the residue under a pressure of 15 mm. A colourless oil amounting to 77 per cent. of the theoretical amount passed over between 163° and 165°. (Found, C = 79·8, H = 7·09. Calc. C = 79·33, H = 7·44 per cent. M.W. by cryoscopic method = 249; Calc. 242; Density, 1·075 at 15°.)

The following boiling points were determined—186°/26 mm., 312°/80 mm.

Efforts to obtain this substance in a crystalline form were in vain, the oil only becoming more viscous. It is easily miscible with the ordinary organic solvents.

As in the case of the corresponding benzophenone derivative, this substance when placed in a desiccator containing sulphuric acid steadily lost weight until the ketone crystallised out, the change being expressed thus:

$$C_6H_4Me\cdot C(OMe)_2\cdot C_6H_5 \longrightarrow C_6H_4Me\cdot CO\cdot C_6H_5 + (CH_3)_2O.$$

Experiments with ethyl and benzyl alcohols and with phenol are in progress.

182. "A synthesis of tetrahydrouric acid." By Edward Percy Frankland.

An attempt to synthesise the hypothetical desoxyuric acid,

$$\begin{matrix} NH\cdot CH_2\cdot C\cdot NH \\ | \quad\quad\quad\quad \| \\ CO-NH-C\cdot NH \end{matrix}\!\!>\!CO,$$

by the addition of cyanic acid to $\alpha\beta$-diaminopropionic acid,

$$NH_2\cdot CH_2\cdot CH(NH_2)\cdot CO_2H,$$

followed by the dehydration of the diurea derivative thus formed, led to the production of tetrahydrouric acid:

$$NH_2\cdot CO\cdot NH\cdot CH_2\cdot \begin{matrix} CH\cdot NH \\ | \quad\quad \\ CO-NH \end{matrix}\!\!>\!CO \text{ or } \begin{matrix} NH\cdot CH_2\cdot CH\cdot NH\cdot CO\cdot NH_2 \\ | \quad\quad\quad\quad\quad\quad \\ CO-NH-CO \end{matrix},$$

only one molecule of water being eliminated to form a hydantoin ring.

The product from the interaction of two molecules of potassium cyanate and one molecule of diaminopropionic acid in the presence of the equivalent quantity of either hydrochloric or hydrobromic acid was evaporated with 25 per cent. hydrochloric acid, the resulting tetrahydrouric acid extracted with methyl alcohol and recrystallised from water. It melts and decomposes at 216° (uncorr.), corresponding with the substance obtained by Tafel (*Ber.*, 1901, **34**, 258) by the electrolytic reduction of uric acid.

183. "The double nitrites of mercury and the bases of the tetra-alkylammonium series." By Prafulla Chandra Rây.

The investigation on the double nitrites of mercury and the alkali metals and the metals of the alkaline earths (*Trans.*, 1907, **91**, 2031; *ibid.*, 1910, **97**, 326) has been extended to the tetra-alkylammonium series. It is well known that the tetra-alkylammonium hydroxides are fairly comparable to the alkali hydroxides in point of strength, the heat of neutralisation of any one of these bases by an equivalent of hydrochloric acid being, on an average, 13,700 calories. It was, therefore, expected that the nitrites of the alkylammonium series should also yield double salts with mercuric nitrite, and this has been found to be the case.

In the interaction of mercuric nitrite and tetra-methylammonium nitrite two distinct compounds were obtained, namely,

$$Hg(NO_2)_2,NMe_4NO_2,H_2O$$

and $Hg(NO_2)_2,2NMe_4NO_2$. The power of combination of mercuric nitrite* with one or more molecules of the alkali nitrite evidently depends on the predominance of the latter in solution.*

Analysis of the compound $Hg(NO_2)_2,NMe_4NO_2,H_2O$ gave:

Found: Hg = 44·64; C = 10·71; N (nitritic) = 9·37.

$Hg(NO_2)_2,NMe_4NO_2H_2O$ requires Hg = 45·00; C = 10·63; N (nitritic) = 10·2 per cent.

The compound $Hg(NO_2)_2,2NMe_4NO_2$ gave:

Found: Hg = 38·2; C = 17·7; N (total) = 16·1.

$Hg(NO_2)_2,2NMe_4NO_2$ requires Hg = 37·6; C = 18·0; N = 15·8 per cent.

* Although the salt $Hg(NO_2)_2,1\frac{1}{2}NaNO_2$ (*loc. cit.*) has been described, the corresponding mercuric potassium compound has not until now been obtained. The author has succeeded in preparing it in a pure state. Analysis of the salt gave:

Found: Hg = 47·72; K = 13·98; N = 11·60.

$Hg(NO_2)_2,1\frac{1}{2}KNO_2$ requires Hg = 47·66; K = 13·98; N = 11·68 per cent.

184. **"Ionisation of the nitrites as measured by the cryoscopic method." (Preliminary note.) By Prafulla Chandra Rây and Satish Chandra Mukherjee.**

The authors gave a preliminary account of their work on the ionisation of the nitrites. This part was carried out in the ordinary way, and the results checked by comparison experiments with potassium nitrate and chloride and sodium chloride. The nitrites were prepared either from silver nitrite or barium nitrite, and treatment with the corresponding chloride or sulphate and evaporation to dryness in a vacuum over sulphuric acid. Instead of weighing these salts directly as many were deliquescent), the authors evaporated the solutions (after the determinations had been made) with sulphuric acid and estimated the strength from the sulphate left. An exception to this was in the case of the tetramethylammonium nitrite, which was dried at 150° and weighed directly.

Salt.	Mol. wt. Calc.	Mol. wt. Found.	Dilution in litres.	Degree of ionisation.	No. of ions.
KNO_3	101·0	56·05	4·4	0·80	2
		54·37	19·0	0·86	2
KCl	74·5	38·2	15·0	0·95	2
		39·7	12·0	0·88	2
NaCl	58·5	31·4	4·2	0·86	2
$Ca(NO_2)_2$	132·0	49·3	28·0	0·84	3
		50·26	19·4	0·82	3
$Ba(NO_2)_2$	229·0	84·9	21·0	0·84	3
		84·0	31·4	0·86	3
$Sr(NO_2)_2$	179·3	66·43	22·0	0·84	3
		66·5	21·0	0·84	3
KNO_2	85·0	45·6	16·0	0·86	2
		46·0	17·0	0·85	2
		46·0	18·0	0·85	2
		44·4	36·0	0·91	2
$NaNO_2$	69·0	36·9	10·0	0·87	2
		36·0	20·5	0·91	2
NH_4NO_2	64·0	35·3	18·0	0·81	2
		34·2	20·0	0·87	2
$N(CH_3)_4NO_2$	120·0	63·0	14·0	0·90	2
		62·0	19·5	0·93	2
$HgCl_2$	271·0	258·6	36·6	0·47	3
$Hg(NO_2)_2$	292·0	238·2	32·0	0·11	3
$K_4Fe(CN)_6$	368·0	104·5	31·0	0·63	5
$Hg(NO_2)_2,2KNO_2$	462·0	131·4	7·2	[1·26]	3
		122·2	21·2	[1·39]	3
		110·65	60·4	[1·58]	3
$2Hg(NO_2)_2,3KNO_2$	839·0	154·0	23·0	[1·48]	3
$Hg(NO_2)_2,2N(CH_3)_4NO_2$.	532·0	134·0	40·0	[1·48]	3
$Hg(NO_2)_2,Ca(NO_2)_2$	424·0	148·3	42·1	[1·86]	2
$3Hg(NO_2)_2,2Ba(NO_2)_2$	1334·0	173·7	126·0	[3·34]	3
$2Hg(NO_2)_2,HgNO_2$	830·0	294·0	64·8	[1·82]	2
		290·8	72·7	[1·85]	2
		299·5	135·2	[1·77]	2

Anomalous results are given in square brackets.

It will be seen that potassium and sodium nitrites on the one hand, and calcium, strontium, and barium nitrites on the other, show

equal degrees of ionisation; thus these nitrites conform to the general rule that salts which have an analogous constitution are ionised to the same extent in dilute solutions of equal concentration.

It is worthy of note, also, that a solution of ammonium nitrite —a compound of a "weak" base and a "weak" acid—shows no deviation from the general rule, and that a solution of tetramethylammonium nitrite is far more strongly dissociated than any of the alkali nitrites, a fact in keeping with the behaviour of other salts of quaternary bases from aliphatic amines.

The results are in agreement with those obtained by other investigators using different methods.

185. "New syntheses of thioxanthone and its derivatives." By Eric Gordon Davis and Samuel Smiles.

It was shown that thioxanthone may be synthesised by warming *o*-carboxybenzenesulphinic acid and benzene with concentrated sulphuric acid; the yields furnished by this process, however, are inferior to those obtained when *o*-thiolbenzoic acid is warmed with benzene and the same condensing agent, about 80—90 per cent. of the required amount being then obtained.

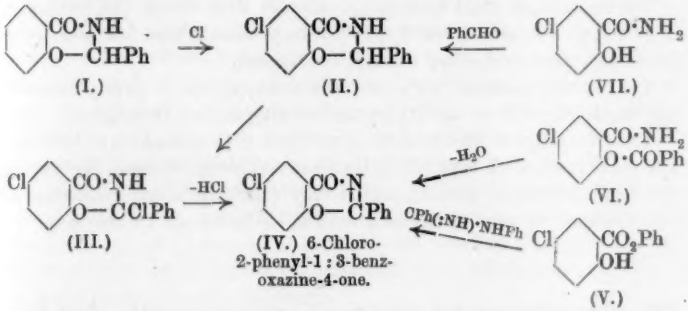
Numerous derivatives have been prepared by the latter method, and the *methyl-*, *hydroxy-*, and *methoxy-thioxanthones* were described in detail, also the preparation of *naphthathioxanthone*, *aminonaphthathioxanthone*, and *naphthabisthioxanthone* has been accomplished by this method. The mechanism of the reaction was discussed, and the conclusion was drawn that the sulphoxylic acid (1)$CO_2H{\cdot}C_6H_4{\cdot}SOH(2)$ is formed as an intermediate product.

186. "The intramolecular rearrangements of diphenylmethane orthosulphoxide." By Thomas Percy Hilditch and Samuel Smiles.

The *o*-sulphoxide of diphenylmethane is obtained by the interaction of hydrogen dioxide and thioxanthen. It is oxidised by potassium permanganate to diphenylmethane *o*-sulphone, and thus differs from thioxanthhydrol, which yields thioxanthone on oxidation under similar conditions. This sulphoxide is transformed by fusion, or by being warmed above its melting point in certain solvents, into thioxanthhydrol, and by acid reagents it is converted into the salts of dibenzocarbothionium. Werner's statement (*Ber.*, 1901, **34**, 3311) that thioxanthhydrol is converted by acids into the salts of that base has been confirmed, although here the change appears to be more rapid than with the sulphoxide. The study of these intramolecular changes is being continued.

187. **"6-Chloro-2-phenyl-1 : 3-benzoxazine-4-one and related derivatives." By Arthur Walsh Titherley and Ernest Chislett Hughes.**

The chlorination of 2-phenyldihydro-1 : 3-benzoxazine-4-one (phenylbenzometoxazone) (I) leads first to the production of the 6-chloro-derivative (m. p. 214°) (II), in which, by further action, the hydrogen atom (2) in the oxazine ring is displaced. The resulting dichloro-derivative (III), however, cannot exist, and by loss of hydrogen chloride yields the chloro-derivative (m. p. 215°) (IV) of the unsaturated cyclic compound recently isolated by Titherley (*Trans.*, 1910, **97**, 200). The unsaturated chloro-derivative (IV) has also been synthesised from phenyl 5-chlorosalicylate (V) and phenylbenzamidine, and from 5-chloro-*O*-benzoylsalicylamide (VI) by internal condensation with hydrogen chloride, whilst the simple chloro-derivative (II) has been synthesised by the condensation of 5-chlorosalicylamide (VII) and benzaldehyde:



The chloro-derivative (II) with pyridine and alkali yields the open-chain isomeride, *syn*-benzylidine-5-chlorosalicylamide,

$$OH\cdot C_6H_3Cl\cdot CO\cdot N{:}CHPh,$$

which is very labile, and on heating rapidly reverts to the cyclic form (II).

O-Benzoyl 5-chlorosalicylamide (VI), which may be readily obtained by the pyridine benzoylation method at $-15°$, rearranges, on heating, to *N*-benzoyl 5-chlorosalicylamide, $OH\cdot C_6H_3Cl\cdot CO\cdot NH\cdot COPh$, and reversible rearrangement of the latter occurs in boiling acetic acid. The same *N*-benzoyl derivative is produced by the hydrolytic rupture of the oxazine ring in (IV) under the influence of acids.

188. "Separation of the metals of the tin group." By Robert Martin Caven.

The following modification of Walker's method (*Trans.*, 1903, **83**, 184) for the qualitative separation of the metals of the tin group has been found rapid and satisfactory. The mixed sulphides are reprecipitated from their solution in alkali, collected, washed, and boiled with concentrated hydrochloric acid according to a well-known method of separation, and the remaining arsenious sulphide, filtered off from the diluted solution, may then be identified in the usual manner by making use of its solubility in ammonium carbonate solution.

To the filtrate, free from hydrogen sulphide and containing antimonious and stannic chlorides, potassium hydroxide is added until the hydroxides precipitated are just re-dissolved in excess of alkali. Bromine water is then added until the solution remains yellow; thus antimonite, which would be hydrolysed in presence of ammonium chloride, is oxidised to antimonate.

The addition of solid ammonium chloride first causes the evolution of nitrogen, because of the hypobromite present; then stannic hydroxide separates, and, after boiling, is collected.

The filtrate contains only the antimony, which is precipitated as antimonic sulphide on acidifying and passing hydrogen sulphide.

The advantage of this scheme of analysis is that it employs Walker's excellent method of separating tin from antimony without postponing the identification of arsenic, which may result in small quantities of this element, present finally as arsenate, being missed by students.

189. "The formation and reactions of imino-compounds. Part XIII. The constitution of ethyl β-imino-α-cyanoglutarate and of its alkyl derivatives." By Arthur Fred Campbell and Jocelyn Field Thorpe.

Ethyl β-imino-α-cyanoglutarate, $CO_2Et\cdot CH_2\cdot C(NH_2):C(CN)\cdot CO_2Et$, reacts entirely as an amino-compound, and appears to have no imino-phase. It is therefore a substituted ethyl glutaconate, and it is now found that in many of its reactions this amino-derivative behaves like glutaconic acid. Thus when one methyl group is introduced, ethyl β-imino-α′-cyano-α-methylglutarate,

$$CO_2Et\cdot CHMe\cdot C(NH_2):C(CN)\cdot CO_2Et,$$

is formed as sole product, whereas when two methyl groups are introduced, the second methyl combines with both the α-carbon atom and the α′-carbon atom, forming ethyl β-imino-α′-cyano-αα-dimethylglutarate,

$CO_2Et \cdot CMe_2 \cdot C(NH_2) : C(CN) \cdot CO_2Et$, and ethyl β-imino-α′-cyano-αα′-dimethylglutarate, $CO_2Et \cdot CMe : C(NH_2) \cdot CMe(CN) \cdot CO_2Et$, showing therefore that there is tautomerism between the α- and α′-carbon atoms as there is between the α- and γ-carbon atoms of glutaconic acid.

It has also been found that ethyl β-imino-α′-cyano-αα-dimethylglutarate can be isolated in two stereoisomeric forms, showing that the substitution of the two α-carbon atoms in ethyl β-imino-α-cyanoglutarate and the consequent "fixing" of the double bond leads, as in the derivatives of glutaconic acid, to the isolation of stereoisomeric modifications.

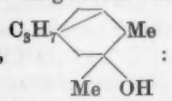
The production of pyrrole derivatives from the sodium compound of ethyl β-imino-α′-cyano-α-methylglutarate by the action of iodoacetonitrile was also described, the formation of these substances proving that the mobile hydrogen atom acted preferentially on the α′-carbon atom.

190. "*p*-**Hydroxyazo-derivatives of quinoline.**" **By John Jacob Fox.**

Hydroxyazo-derivatives of quinoline, such as 5-p-*aminobenzeneazo*-8-*hydroxyquinoline*, were described, having the hydroxyl group in the ortho-position with respect to the nitrogen in the quinoline nucleus; and the properties of these substances were compared with the corresponding derivatives in which the hydroxyl group was not in the quinoline nucleus. It was shown that, whilst the latter could be acetylated and ethylated in the usual way, the former did not under ordinary conditions yield acetyl or alkyloxy-derivatives. It was pointed out that the carbonium structure for the polyhydrochlorides was inadequate to account for the marked instability of the hydrochlorides of the hydroxyazo-derivatives of 8-hydroxyquinoline as compared with quinolineazophenol.

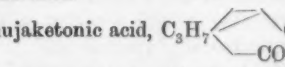
The absorption spectra show bands of which the heads occur at oscillation frequencies in about the same position as in the simpler hydroxyazo-derivatives, as, for example, dimethylaminobenzeneazophenol.

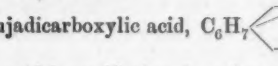
191. "**A contribution to the study of tanacetone** (β-thujone) **and some of its derivatives.**" **By David Thomson.**

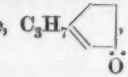
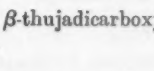
Tanacetone (β-thujone), when treated with magnesium methyl iodide, yields two tertiary homothujyl alcohols, 

: one a solid, melting at 84°, and having $[\alpha]_D$ −30·5°; the other a liquid, boiling at 204°, and having $[\alpha]_D$ +35°. In both these alcohols, as in

thujyl alcohol, the *cyclo*propane ring is stable towards cold 5 per cent. sulphuric acid.

α-Thujaketonic acid,  , is decomposed by boiling with 20 per cent. hydrochloric acid solution, with the formation of an unsaturated hydrocarbon, which in odour and boiling point is similar to dihydro-ψ-cumene.

α-Thujadicarboxylic acid,  , prepared from α-thujaketonic acid by oxidation, is quite stable towards boiling 20 per cent. hydrochloric acid or boiling 10 per cent. sodium hydroxide. α-Thujadicarboxylic acid can be easily esterified in the ordinary way. The *dimethyl*, *diethyl*, *di*-n-*propyl*, *diisobutyl*, and *diisoamyl* esters have been prepared. All are colourless, odourless liquids.

The dimethyl and diethyl esters of α-thujadicarboxylic acid give a sodio-derivative, the decomposition products of which are tanacetophorone,  , β-thujadicarboxylic acid,  , and an unknown inactive dicarboxylic acid, $C_9H_{14}O_4$, melting at 150—151°.

192. "Pentane- and *iso*pentane-αβδ-tricarboxylic acids." By Edward Hope and William Henry Perkin, jun.

These acids were prepared for the purpose of comparison with acids which had been obtained by the degradation of some new terpenes which will shortly be described. *Ethyl β-cyanopentane-αβδ-tricarboxylate*, $CO_2Et\cdot CH_2\cdot C(CN)(CO_2Et)\cdot CH_2\cdot CHMe\cdot CO_2Et$, prepared by the action of ethyl bromoacetate on the sodium derivative of ethyl γ-cyano-α-methylglutarate, $CO_2Et\cdot CH(CN)\cdot CH_2\cdot CHMe\cdot CO_2Et$, distils at about 195—215°/17 mm., and, when digested with dilute sulphuric acid and the resulting crude acid esterified, is converted into *ethyl pentane-αβδ-tricarboxylate*. This ester distils at 178—182°/19 mm., and yields, on hydrolysis, *pentane-αβδ-tricarboxylic acid*,

$$CO_2H\cdot CH_2\cdot CH(CO_2H)\cdot CH_2\cdot CHMe\cdot CO_2H,$$

which melts at about 158°.

Ethyl β-cyanoisopentane-αβδ-tricarboxylate,

$$CO_2Et\cdot CH_2\cdot C(CN)(CO_2Et)\cdot CHMe\cdot CH_2\cdot CO_2Et,$$

prepared in a similar manner from ethyl γ-cyano-β-methylglutarate, $CO_2Et\cdot CH(CN)\cdot CHMe\cdot CH_2\cdot CO_2Et$, and ethyl bromoacetate, distils at about 195—215°/13 mm., and yields, on hydrolysis and subsequent

esterification, *ethyl* iso*pentane-αβδ-tricarboxylate*, which distils at 180—183°/20 mm.

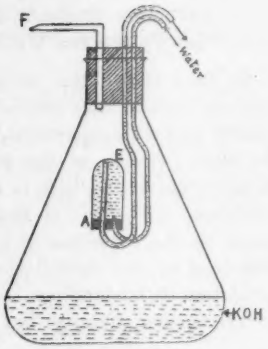
iso*Pentane-αβδ-tricarboxylic acid*,

$$CO_2H{\cdot}CH_2{\cdot}CH(CO_2H){\cdot}CHMe{\cdot}CH_2{\cdot}CO_2H,$$

melts at about 154—156°.

193. **"The action of pure air and water on iron and steel." (Preliminary note.) By John Albert Newton Friend.**

The electrolytic theory of the corrosion of iron first advanced by Whitney in 1903 has, during the past few years, been received with increasing favour, chiefly because a considerable number of investigators, both in this country and in America, have failed to retain iron in a rust-free condition in the presence of liquid water and oxygen. The absence of rust in Moody's experiments is attributed to passivity induced by the chromic acid employed, as also to the presence of alkali dissolved out of the glass vessels containing the iron. The results of the author's own experiments (*J. Iron and Steel Inst.*, 1908, No. II, 5) are explained away in a somewhat similar manner (see W. H. Walker, *ibid.*, 1909, No I, 69; and Friend, *ibid.*, 1909, No II, 257).



In order to demonstrate the untenability of such an explanation, the following experiment has been devised, which shows in a remarkably clear and simple manner that pure water and air alone are incapable of effecting the corrosion of pure iron and steel.

AE is a hollow cylinder (of iron or steel) closed at one end. The open end is fitted to a tightly fitting rubber stopper bearing two glass tubes, as shown in the figure, and arranged in such a way that cold water can circulate freely through them. The cylinder is well polished with sand-paper, and secured as shown inside a conical flask containing about 150 c.c. of 3*N*-potassium hydroxide solution. The air is partly removed, and the vessel hermetically sealed at *F*. The flask is now placed to half its depth in a water-bath at 100°, after having been thoroughly shaken to remove every trace of carbon dioxide from its walls, etc., and a current of cold water passed through *AE*. The pressure of the air is not sufficiently reduced to allow the potash to boil, nevertheless pure water vapour condenses on *AE* and drips off, thus slowly washing it free from alkali.

After this process has been continued for several days, not a trace of alkali remains on *AE*, as is readily shown by opening the apparatus and testing with phenolphthalein. Nevertheless, if the iron is pure, it remains quite bright, thus proving that pure water and pure air combined are without action on pure iron. In one of the experiments two spots of rust were formed after twenty-four hours at the bend *E*, although the rest of the metal remained bright for several days when the apparatus was opened. This rusting was undoubtedly due to traces of slag in the metal, for on repeating the experiment, after thoroughly cleaning the iron, two spots of rust formed again in a precisely similar place. Repetition with a fresh sample of steel gave no rust whatever.

194. "*iso*Quinoline derivatives. Part V. The constitution of the reduction products of papaverine" (continued). By Frank Lee Pyman and William Colebrook Reynolds.

In Part II. of this series (*Trans.*, 1909, **95**, 1610) one of the authors showed that Goldschmiedt's "tetrahydropapaverine" was in reality a dihydropapaverine, and termed it "1 : 2-dihydropapaverine." In view, however, of the properties of its *N*-methyl derivative, the constitution of the base is regarded as unsettled. It is proposed to designate it *pavine*. N-*Methylpavine* is formed together with laudanosine by the reduction of papaverine methyl salts, and may also be obtained by the methylation of pavine; it is also formed in the oxidation of laudanosine.

The further investigation of this compound is in progress.

195. "The specific rotatory power of hyoscyamine and the relation between that of alkaloids and their salts." By Francis Howard Carr and William Colebrook Reynolds.

The specific rotatory power of pure *l*-hyoscyamine is $-22{\cdot}0°$ in 50 per cent. ethyl alcohol, whilst that of its basic ion taken in aqueous solutions of the salt is $-32{\cdot}5°$.

Barrowcliff and Tutin (*Trans.*, 1909, **95**, 1966) stated that the lower value for the free base was due to racemisation occurring in the process of preparing it from its salts. It is now shown that racemisation does not take place so very readily as supposed by these authors—pure *d*- and *l*-hyoscyamine having $[\alpha]_D - 22{\cdot}0°$—but that the specific rotatory power of hyoscyamine and of many other alkaloids differs widely from that of their respective basic ions taken in solution of a salt.

The free alkaloids behave as though they are not ionised, or only partly so, when dissolved in water or in 50 per cent. ethyl alcohol, the nitrogen retaining a triad function.

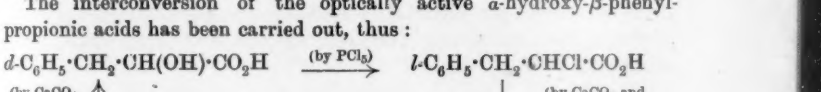
The rotatory power of a number of alkaloids and their salts has been determined, and some observations bearing upon the influence of different solvents have been made.

196. "**Experiments on the Walden inversion. Part V. The interconversion of the optically active α-hydroxy-β-phenylpropionic acids.**" **By Alex. McKenzie and Henry Wren.**

The resolution of *r*-α-hydroxy-β-phenylpropionic acid into its optically active components was described.

The displacement of bromine in the active α-bromo-β-phenylpropionic acids by the hydroxy-group has been examined.

The interconversion of the optically active α-hydroxy-β-phenylpropionic acids has been carried out, thus:



This is the first example recorded where phosphorus pentachloride appears to act abnormally. The isomeric acids,

$$C_6H_5\cdot CH(OH)\cdot CH_2\cdot CO_2H,$$

$C_6H_5\cdot CH_2\cdot CH(OH)\cdot CO_2H$, and $\begin{matrix}C_6H_5\\CH_3\end{matrix}\!\!>\!C\!<\!\!\begin{matrix}OH\\CO_2H\end{matrix}$, thus differ from one another from the point of view of the Walden inversion.

197. "**Carthamine.**"
By Tokuhei Kametaka and Arthur George Perkin.

It was suggested (*Proc.*, 1909, **25**, 223) that carthamine, the colouring matter of safflower, possessed the formula $C_{15}H_{14}O_7$, rather than $C_{14}H_{16}O_7$, originally assigned to it by Schlieper (*Annalen*, 1846, **58**, 362), but further experiment now indicates that the much higher formula $C_{25}H_{24}O_{12}$ is most probably correct. Carthamine, when dried in the air, crystallises with $2H_2O$, gives with dilute alcoholic potassium acetate the salt $C_{25}H_{23}O_{12}K$, green, iridescent needles, and an amorphous benzoyl compound, probably $C_{25}H_{17}O_{12}(C_7H_5O)_7$, melting at 230—232°, has been obtained. Although Schlieper obtained a yellow substance, $C_{14}H_{14}O_9$, by boiling carthamine with alcohol, and Radcliffe (*J. Soc. Dyers*, 1897, **13**, 159) noticed a similar decomposition, experiment has failed to reproduce this. When carthamine is boiled with

alcoholic aniline it gives a substance $C_{25}H_{24}O_{12},C_6H_7N$, long, yellow needles, melting and decomposing at 276—278°, soluble in alkalis with a yellow colour, and for which the name *aniline xantho-carthaminate* is proposed.

β-Naphthylamine gives the compound $C_{25}H_{24}O_{12},C_{10}H_9N$, orange leaflets, melting and decomposing at 266—268°, and the corresponding derivative of ψ-cumidine forms orange leaflets, melting and decomposing at 290°. A molecular-weight determination of carthamine kindly carried out by Dr. Barger by his microscopic method gave M.W. = 551, whereas the formula $C_{25}H_{24}O_{12}$ requires M.W. = 516.

With nitric acid, carthamine gives picric acid. When digested with boiling 50 per cent. potassium hydroxide, it yields *p*-coumaric acid and *p*-hydroxybenzaldehyde, and by the prolonged action of one per cent. alkali or strong baryta water is similarly decomposed. Hydrogen peroxide in presence of sodium carbonate also produces *p*-coumaric acid, and in a similar way the crude methylation product of carthamine yields with hydrogen peroxide, *p*-methoxycinnamic acid, and probably *p*-methoxycinnamaldehyde, and with chromic acid, anisaldehyde and anisic acid.

198. "Note on gynocardin and gynocardase." By Charles Watson Moore and Frank Tutin.

Gynocardinic acid (*Trans.*, 1905, **87**, 349), when methylated by means of dry silver oxide and methyl iodide, yields *methyl pentamethylgynocardinate*, $C_{12}H_{14}O_4(OMe)_5{\cdot}CO_2Me$, which is a liquid boiling at 220°/15 mm. No definite products could be obtained by the hydrolysis of this methyl derivative.

Gynocardin possesses feebly acidic properties, and yields compounds with the alkali metals; the *sodium* derivative has the formula $C_{13}H_{18}O_9NNa$.

The action of emulsin and of gynocardase on gynocardin, amygdalin, *l*-mandelonitrile glucoside, and salicin has been quantitatively determined.

199. "Note on quercitrin." By Charles Watson Moore.

The glucoside quercitrin is usually stated in chemical literature to possess the formula $C_{21}H_{22}O_{12}$, and its hydrolysis, with the formation of quercetin and rhamnose, has therefore been represented as follows:

$$C_{21}H_{22}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{14}O_6.$$

It is evident, however, that this equation cannot be correct, inasmuch as it is now known that rhamnose possesses the formula

$C_6H_{12}O_5$, but that it crystallises with one molecule of water. According to Brauns (*Arch. Pharm.*, 1904, **242**, 561), quercitrin possesses the formula $C_{21}H_{20}O_{11},2H_2O$, and its hydrolysis would therefore take place quite normally by the absorption of one molecule of water as follows:

$$C_{21}H_{20}O_{11} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_5.$$

In the course of some experiments on quercitrin it was deemed desirable to confirm the formula assigned to it by Brauns (*loc. cit.*), and in this connexion some other observations concerning the glucoside may be recorded:

1·6548 of air-dried glucoside, when heated at 125°, lost 0·1274 H_2O. $H_2O = 7·7$.

0·1794 * gave 0·3700 CO_2 and 0·0734 H_2O. $C = 56·2$; $H = 4·5$.

$C_{21}H_{20}O_{11},2H_2O$ requires $H_2O = 7·4$ per cent.

$C_{21}H_{20}O_{11}$ requires $C = 56·2$; $H = 4·5$ per cent.

These results are thus seen to be in agreement with the formula assigned to quercitrin by Brauns (*loc. cit.*).

The melting points of carefully purified quercitrin have likewise been observed to differ considerably from those recorded in the literature. It has, for example, been stated (compare Brauns, *loc. cit.*) that the air-dried glucoside melts at 174—176°, and the anhydrous substance at 168°. The correct melting points are, however, 183—185° and 250—252° respectively.

A determination of the specific rotatory power of the air-dried glucoside gave the following result:

0·2224, made up to 20 c.c. with pyridine, gave α_D −1°34′ in a 1-dcm. tube, whence $[\alpha]_D$ −140·9°.

If to an alcoholic solution of quercitrin an excess of sodium ethoxide be added, a *trisodium* derivative is precipitated. This forms a dark yellow powder, sparingly soluble in cold alcohol:

0·2974 gave 0·0870 Na_2CO_3. $Na = 12·9$.

$C_{21}H_{17}O_{11}Na_3$ requires $Na = 13·4$ per cent.

Attempts to prepare the corresponding methyl derivative from the sodium derivative were unsuccessful, as were also those to obtain a crystalline acetyl or benzoyl derivative of quercitrin.

* Anhydrous substance.

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Tibbals, *Charles Austin*. A study of tellurides. (From the *Bull. Univ. Wisconsin, Sci. Ser.*, 1909, 3.)

Tuveri, *S.* Sull' azione del torio sul cuore normale ed in degenerazione grassa. (From the *Arch. Farm. sper. Sci. affini.* 1909, 8.)

Waidner, *C. W.*, and **Burgess**, *G. K.* Platinum resistance thermometry at high temperatures. (From the *Bull. Bureau of Standards*, 1909, 6.)

BANQUET TO PAST PRESIDENTS.

The Banquet (postponed from May 26th) will be held at the Savoy Hotel (Embankment Entrance) on **Friday, November 11th, 1910**, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887,
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, November 4th, 1910.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 8th,** until **Saturday, August 20th,** 1910, inclusive.

Fellows are particularly requested to return all Library Books in their possession not later than **Wednesday, August 3rd.**

LIST OF FELLOWS, 1910.

The List of Fellows for 1910 is now in active preparation, and changes of address received after 30th June cannot be included in it.

In order that the new list may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

ERRATA.

PROCEEDINGS, 1910.

Page	Line	
91	5*	*for* "2-methyl-1 : 3-benzoxazine-4-one" *read* "2-methyl-1 : 3-dihydrobenzoxazine-4-one."
149	6	*for* "[the late] James Campbell Brown" *read* "[the late] James Campbell Brown and John Smeath Thomas."

* From below.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY, SUFFOLK.

Issued 29/10/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 375.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
SOUTH KENSINGTON,
LONDON, S.W.
August 22nd, 1910.

GENTLEMEN,

I beg to forward the Annual Report of the International Committee on Atomic Weights for 1911, to which I have appended, by their desire, the signatures of Professors Ostwald and Urbain.

The Committee, it will be seen, have acceded to the wish of the Council of the Chemical Society, and have prepared the Report in such time that it can be published prior to the commencement of the ensuing academic year.

Slight changes have been made in the atomic weights of argon, helium, krypton, lithium, neon, phosphorus, platinum, strontium, vanadium, and xenon, but otherwise the new table remains very much as in 1910.

I have the honour to be, Gentlemen,
Your obedient servant,
T. E. THORPE.

To the Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.

Report of the International Committee on Atomic Weights, 1911.

In the autumn of 1909 the Council of the Chemical Society of London voted unanimously in favour of issuing the annual report of the International Committee on Atomic Weights in September or October instead of in January as heretofore. In that proposition the Chemical Society of France has concurred, and American sentiment has also been favourable to the suggested change. Therefore the change is now made.

The reasons offered for the new policy are very simple. First, the school year, at least in most educational institutions, begins in the autumn. It is desirable that teachers should then have the latest table of atomic weights at their command, in order to avoid changes after school work has begun. Secondly, publishers of text-books are accustomed to issue their new works in the autumn, and often request early information as to changes which are likely to be made. The proposed change in the time of issuing the table is therefore an aid to teachers, students, and publishers, and no disadvantage to anyone else. The immediate usefulness of the table is increased, and to attain that end should be the main purpose of the Committee.

Since the preparation of the report for 1910, a number of important memoirs upon atomic weights have appeared. The results obtained are, in brief, as follows:

Chlorine.—The density, composition by volume, and compressibility of hydrochloric acid have been measured by Gray and Burt (Trans., 1909, **95**, 1633) with great care. From the density and volumetric composition, when H = 1·00762, Cl = 35·459. From the density and compressibility, Cl = 35·461. The mean, 35·460, is the value given in the annual table of atomic weights for the past two or three years.

The density of hydrochloric acid has also been determined by Scheuer (*Zeitsch. physikal. Chem.*, 1909, **68**, 575), who gives measurements made under varying conditions. His final conclusion, based upon his own work after comparison with that of Gray and Burt, is that Cl = 35·466.

Lithium.—Richards and Willard (*J. Amer. Chem. Soc.*, 1910, **32**, 4), in their important research upon the atomic weight of lithium, measured three distinct ratios, namely, silver to lithium chloride, silver chloride to lithium chloride, and lithium perchlorate to lithium chloride. From these ratios, without the intervention of

any others, the following independent values for three atomic weights are obtained:

Li = 6·939.
Cl = 35·454.
Ag = 107·571.

The value for silver varies from the accepted value, 107·88, by about one part in 12,000, which is probably less than the actual uncertainty. That for chlorine diverges more widely, namely, by about one part in 6000. The new figures are undoubtedly entitled to great weight, but in view of the excellent work done by others it would be unwise to make any hasty change in the table. For lithium, however, the value 6·94 may be taken, replacing the old 7·00.

Strontium.—Thorpe and Francis (*Proc. Roy. Soc.*, 1910, **83**, *A*, 277), in their determinations of the atomic weight of strontium, measured six ratios, and obtained the following results:

Ratio	$2Ag$ to $SrBr_2$	Sr = 87·645
,,	$2AgBr$ to $SrBr_2$	,, = 87·653
,,	$2Ag$ to $SrCl_2$	,, = 87·642
,,	$2AgCl$ to $SrCl_2$	,, = 87·645
,,	$SrBr_2$ to $SrSO_4$.....	,, = 87·629
,,	$SrCl_2$ to $SrSO_4$.....	,, = 87·661
	Mean of all	Sr = 87·646

The value adopted by the authors is 87·65. Richards's figure is 87·62. An intermediate value, 87·63, is adopted in the new table.

Phosphorus.—Atomic weight redetermined by Baxter and Jones (*J. Amer. Chem. Soc.*, 1910, **32**, 298). From the ratio between silver and silver triphosphate, the authors find P = 31·043, when Ag = 107·88. The rounded-off figure 31·04 is to be adopted.

Vanadium.—From the ratio between silver chloride and vanadyl trichloride, Prandtl and Bleyer (*Zeitsch. anorg. Chem.*, 1910, **65**, 152) find V = 50·963 and 51·133 in two series of experiments. In a later paper, Prandtl and Bleyer (*Zeitsch. anorg. Chem.*, 1910, **67**, 257), also from analyses of vanadyl trichloride, find V = 51·061. From reductions of V_2O_5 to V_2O_3, they found V = 51·374. The latter method, however, they regard as uncertain. The value V = 51·06 may be provisionally adopted.

Tellurium.—Marckwald and Foizik (*Ber.*, 1910, **43**, 1710; see also Browning and Flint, *Amer. J. Sci.*, 1909, [iv], **28**, 347, who adduce evidence to show that tellurium is possibly complex), by a somewhat complex volumetric process, based on the oxidation of TeO_2 by $KMnO_4$, conclude that Te = 127·61. This agrees with

many of the other recent determinations of the constant, but is not sufficiently exact to supplant the value given in the table.

Rhodium.—Two inaugural dissertations upon the atomic weight of rhodium have been issued from Gutbier's laboratory at Erlangen. Renz reduced rhodium pentamine bromide in hydrogen and found Rh = 102·92. H. Dittmar (reproduced in *Sitzungsber. phys. med. Soz. Erlangen*, **40**, 184), by similar reductions of the corresponding chloride, found Rh = 102·93.

Platinum.—The very elaborate investigation of Archibald (*Proc. Roy. Soc. Edin.*, 1909, **29**, 721) upon the atomic weight of platinum was based upon analyses of the chloroplatinates and bromoplatinates of potassium and ammonium. In all, 28 ratios were measured, giving values for Pt ranging between 195·19 and 195·25. Their arithmetical mean gives Pt = 195·22. Archibald, however, in his final discussion, uses only 12 ratios, giving, in mean, Pt = 195·23. The figure 195·2 is given in the table.

The Inert Gases.—The densities and molecular weights of helium and neon have been redetermined by Watson (Trans., 1910, **97**, 810). For the atomic weights he finds He = 3·994 and Ne = 20·200. In another paper (*ibid.*, **97**, 833) he applies the critical constants of krypton and xenon to their densities as determined by Moore, and finds Kr = 82·92 and Xe = 130·22. There are also new determinations of the density of argon by Fischer and Hehnel (*Ber.*, 1910, **43**, 1435). Their mean value, referred to O = 16, is 19·945, a figure rather higher than that given by Ramsay and Travers. It corresponds to an atomic weight of A = 39·89.

It is also to be noted that a third, revised edition of Clarke's "Recalculation of the Atomic Weights" has recently been published by the Smithsonian Institution.

The annual table of atomic weights for 1911 follows, with but few changes from that of the preceding year.

F. W. Clarke.
W. Ostwald.
T. E. Thorpe.
G. Urbain.

1911.

International Atomic Weights.

		O=16.
Aluminium	Al	27·1
Antimony	Sb	120·2
Argon	A	39·88
Arsenic	As	74·96
Barium	Ba	137·37
Bismuth	Bi	208·0
Boron	B	11·0
Bromine	Br	79·92
Cadmium	Cd	112·40
Cæsium	Cs	132·81
Calcium	Ca	40·09
Carbon	C	12·00
Cerium	Ce	140·25
Chlorine	Cl	35·46
Chromium	Cr	52·0
Cobalt	Co	58·97
Columbium	Cb	93·5
Copper	Cu	63·57
Dysprosium	Dy	162·5
Erbium	Er	167·4
Europium	Eu	152·0
Fluorine	F	19·0
Gadolinium	Gd	157·3
Gallium	Ga	69·9
Germanium	Ge	72·5
Glucinum	Gl	9·1
Gold	Au	197·2
Helium	He	3·99
Hydrogen	H	1·008
Indium	In	114·8
Iodine	I	126·92
Iridium	Ir	193·1
Iron	Fe	55·85
Krypton	Kr	82·9
Lanthanum	La	139·0
Lead	Pb	207·10
Lithium	Li	6·94
Lutecium	Lu	174·0
Magnesium	Mg	24·32
Manganese	Mn	54·93
Mercury	Hg	200·0
Molybdenum	Mo	96·0
Neodymium	Nd	144·3
Neon	Ne	20·2
Nickel	Ni	58·68
Nitrogen	N	14·01
Osmium	Os	190·9
Oxygen	O	16·00
Palladium	Pd	106·7
Phosphorus	P	31·04
Platinum	Pt	195·2
Potassium	K	39·10
Praseodymium	Pr	140·6
Radium	Ra	226·4
Rhodium	Rh	102·9
Rubidium	Rb	85·45
Ruthenium	Ru	101·7
Samarium	Sa	150·4
Scandium	Sc	44·1
Selenium	Se	79·2
Silicon	Si	28·3
Silver	Ag	107·88
Sodium	Na	23·00
Strontium	Sr	87·63
Sulphur	S	32·07
Tantalum	Ta	181·0
Tellurium	Te	127·5
Terbium	Tb	159·2
Thallium	Tl	204·0
Thorium	Th	232·0
Thulium	Tm	168·5
Tin	Sn	119·0
Titanium	Ti	48·1
Tungsten	W	184·0
Uranium	U	238·5
Vanadium	V	51·06
Xenon	Xe	130·2
Ytterbium (Neoytterbium)	Yb	172·0
Yttrium	Y	89·0
Zinc	Zn	65·37
Zirconium	Zr	90·6

The following are abstracts of papers received during the vacation and published or passed for publication in the *Transactions*:

200. "Δ^3-*p*-**Menthenol(8) and** $\Delta^{-3:8(9)}$-*p*-**menthadiene.**" **By William Henry Perkin, jun., and Otto Wallach.** (Trans., 1910, 1427.)

The authors have prepared the above substances and several of their derivatives from two sources, namely, from 1-methyl-Δ^3-*cyclo*hexene-4-carboxylic acid and from 4-acetyl-1-methyl-Δ^3-*cyclo*hexene:

$$\left.\begin{array}{l}\mathrm{CHMe}\langle\begin{array}{l}\mathrm{CH_2-CH}\\ \mathrm{CH_2\cdot CH_2}\end{array}\rangle\mathrm{C\cdot CO_2H}\\ \mathrm{CHMe}\langle\begin{array}{l}\mathrm{CH_2-CH}\\ \mathrm{CH_2\cdot CH_2}\end{array}\rangle\mathrm{C\cdot COMe}\end{array}\right\rangle \longrightarrow \mathrm{CHMe}\langle\begin{array}{l}\mathrm{CH_2-CH}\\ \mathrm{CH_2\cdot CH_2}\end{array}\rangle\mathrm{C\cdot CMe_2\cdot OH},$$

and they give a careful comparison of the physical properties of these substances with those of terpineol, limonene, and their corresponding derivatives.

201. "**Freezing-point curve for mixtures of camphor and phenol.**" **By John Kerfoot Wood and Janet Drummond Scott.** (Trans., 1910, 1573.)

The authors have determined the freezing points of a large number of mixtures of camphor and phenol, ranging in composition from pure phenol on the one hand to pure camphor on the other. The form of the freezing-point curve indicates the formation of a compound, the freezing point of which is $-18{\cdot}6°$, between equimolecular proportions of camphor and phenol. The curve also shows that eutectic mixtures are produced when the molecular percentage of camphor in the mixture amounts to either 29·5 or 59·21; in the former case the eutectic mixture is composed of phenol and the compound, and in the latter case of camphor and the compound. The freezing points of the two eutectic mixtures are respectively $-30{\cdot}5°$ and $-32{\cdot}0°$.

No evidence was obtained by the authors as to the existence of the hemi-camphoride of phenol mentioned by Léger (*Compt. rend.*, 1890, **111**, 109).

202. "**The absorption spectra of aniline and its homologues as vapours, as liquids, and in solution.**" **By John Edward Purvis.** (Trans., 1910, 1546.)

The results of this investigation show that: (1) the vapour of aniline has a considerable number of absorption bands, which show relationships amongst themselves both in structure and in differences of wave-lengths; (2) the vapours of the homologues of aniline show none of these absorption bands; (3) the solutions in alcohol show

absorption bands in all the substances, and the type and position of the bands are regulated by the replacement, by alkyl groups, of the hydrogen in the amino-group or in the nucleus; (4) none of the substances in the liquid condition exhibit absorption bands through the thinnest films of 0·001 mm. thick. The phenomena are discussed from a consideration of the vibrations of symmetrically and unsymmetrically oriented molecules in different physical conditions.

203. "**Condensations of phenanthraquinone with ethyl malonate and ethyl acetoacetate.**" **By Marion Brock Richards.** (Trans., 1910, 1456.)

Japp and Wood (*Trans.*, 1905, **87**, 712) described some condensations of phenanthraquinone with ketonic compounds under the influence of acetic anhydride containing a little concentrated sulphuric acid.

The condensation products of phenanthraquinone with ethyl malonate and with ethyl acetoacetate, of which mention was made in that paper, have now been further investigated.

In the case of the ethyl malonate reaction, two compounds were obtained, namely, *ethyl phenanthroxylacetoxymalonate*, $C_{23}H_{22}O_7$ (m. p. 109·5°), and *ethyl 2-keto-3-acetoxy-4 : 5-diphenylene-2 : 3-dihydrofuran-3-carboxylate*, $C_{21}H_{16}O_6$ (m. p. 163·5°), and it was found that the former could be transformed into the latter compound by further action of the reagent. Reduction of the second compound with hydriodic acid yielded *2-keto-4 : 5-diphenylene-2 : 3-dihydrofuran*, $C_{16}H_{10}O_2$ (m. p. 177°), from which the corresponding acid, *9-hydroxy-10-phenanthrylacetic acid*, $C_{16}H_{12}O_3$ (m. p. 182—183°), was also prepared.

The ethyl acetoacetate reaction also gave two compounds, namely, *ethyl 9-phenanthroxylacetoxyacetoacetate*, $C_{22}H_{20}O_6$ (m. p. 148°), and a *substance*, $C_{22}H_{18}O_5$ (m. p. above 315°), and, again, further action of the reagent caused the first substance to be transformed into the second.

204. "**The constitution and mutarotation of sugar anilides.**" **By James Colquhoun Irvine and David McNicoll.** (Trans., 1910, 1449.)

The anilides of tetramethyl mannose, tetramethyl galactose, and trimethyl rhamnose have each been obtained crystalline in mutarotatory forms. The compounds are recovered unchanged after treatment with silver oxide and methyl iodide, and are thus to be regarded as derivatives of the γ-oxidic forms of the parent sugars.

As the anilides of the corresponding unsubstituted sugars are

very readily hydrolysed, the method of determining their constitution by the results of alkylation (*Trans.*, 1908, **93**, 1429) cannot be applied, but their structural resemblance to the methylated γ-oxidic anilides is shown in the mutarotation exhibited by the compounds. Mannoseanilide, galactoseanilide, and rhamnoseanilide have accordingly been re-examined, and found to display optical changes which are comparable in every way with those shown by the methylated anilides.

Comparison of the optical effects due to glucoside and anilide formation, from sugars, and from methylated sugars, shows that the forms of the anilides isolated in the pure state by crystallisation are directly comparable with β-glucosides.

205. "Cyclic di- and tri-ketones." By **Siegfried Ruhemann.**
(Trans., 1910, 1438.)

The diketopyrrolines condense with *o*-phenylenediamine with the production of phenazines. Diketodiphenylpyrroline and diketophenyl-*p*-tolylpyrroline, respectively, yield thus: *diphenylpyrrolinophenazine*, $\begin{matrix} C_6H_5\cdot C & \text{---} & C\cdot N \\ C_6H_5\cdot C\cdot NH\cdot C & & C\cdot N \end{matrix}\!>C_6H_4$, or its homologue. These compounds, like all other members of this group, are yellow, but the condensation product, $C_{20}H_{16}ON_2$, which is formed from *o*-phenylenediamine and diketoacetylphenylmethyl*cyclo*pentene, $CHAc<\begin{matrix} CMe\cdot CPh \\ CO\text{---}CO \end{matrix}$, is purple. This fact indicates that the substance $C_{20}H_{16}ON_2$ has not the constitution of the phenazines, but $CMe<\begin{matrix} CPh\cdot C\cdot NH \\ CAc\cdot C=N \end{matrix}\!>C_6H_4$, and that its formation is preceded by the change of the diketo*cyclo*pentene derivative, $C_{14}H_{12}O_3$, into its tautomeric form, which exists, also, in the blue salts of this diketone (see *Trans.*, 1909, **95**, 984).

With the view of preparing 1 : 2-diketohydrindene,

$$C_6H_4<\begin{matrix} CO \\ CH_2 \end{matrix}\!>CO,$$

the author studied the action of *p*-nitrosodimethylaniline on α-hydrindone, $C_6H_4<\begin{matrix} CO \\ CH_2 \end{matrix}\!>CH_2$, and found that the nitroso-compound attacks both CH_2 groups of the hydrindone. The green condensation product, $C_{25}H_{26}O_2N_4$, which is formed, is decomposed by dilute sulphuric acid, and yields the colourless *hydrate* of *triketohydrindene*, $C_6H_4<\begin{matrix} CO \\ CO \end{matrix}\!>C(OH)_2$. Its physical properties and some of its interesting reactions are described.

206. **"The relation between solubility and the physical state of the solvent in the case of the absorption of carbon dioxide in *p* azoxyphenetole." By Ida Frances Homfray.** (Trans., 1910, 1669).

A homogeneous solution phase, in the normal liquid or gaseous states, may be present in equilibrium with practically all solids, liquids, or gases in other co-existing phases. In the case of mixtures in the so-called solid state, however, a distinction must be drawn between the crystalline and the amorphous forms. The term solid should, strictly speaking, be confined to the former, the latter having rather the properties of a highly supercooled fluid. All available evidence appears to show that the directive forces of crystallisation almost entirely prevent molecular interpenetration. *p*-Azoxyphenetole is a crystalline substance, which melts at 138° to a crystalline liquid, changing at 165° to an isotropic normal liquid. The absorption of carbon dioxide in these phases has been determined in a specially constructed apparatus, unabsorbed gaseous volumes being measured. It was found that no absorption takes place in the solid, crystalline phase. After the first melting point, some absorption occurs. On further raising the temperature, thermal expansion continues until the clearing point is reached. Then, however, a second maximum volume is passed through, a very considerable increase of absorption occurring. After equilibrium has again been established, thermal expansion and decrease of solubility proceed regularly. On reversing the process, the same maximum and minimum readings are repeated.

The remarkable result is thus obtained that, in spite of the lower temperature of the crystalline liquid phase, its solvent power is much smaller than that of the isotropic phase, whilst solution or adsorption in the solid phase is entirely absent.

207. **"The triazo-group. Part XIV. Azoimides of the acetoacetic series." By Martin Onslow Forster and Sidney Herbert Newman.** (Trans., 1910, 1360).

For the purpose of comparison with azoimides of the malonic series, *methyl* and *ethyl α-triazomethylacetoacetates*, *ethyl α-triazoethylacetoacetate*, and *ethyl αα-bistriazoacetoacetate* were prepared by interaction of the corresponding chloro-derivatives and sodium azide. In each case the triazo-ester was obtained with much greater difficulty than was presented by the triazomalonic esters.

Ethyl α-triazomethylacetoacetate is transformed by ammonia into α-triazopropionamide, whilst hydrochloric acid resolves it into diacetyl.

208. "Optically active methoxysuccinic acid from malic acid." By Thomas Purdie and George Ballingall Neave. (Trans., 1910, 1517).

The authors have prepared the methyl, ethyl, and propyl esters of *l*-methoxysuccinic acid by methylating malic esters with methyl iodide and silver oxide with the object of controlling and extending the polarimetric observations formerly made (*Trans.*, 1893, **63**, 217, and succeeding papers) on the same compounds, obtained by resolution of inactive methoxysuccinic acid with the aid of alkaloids. The values of the rotatory powers of the esters and acid from the two different sources are in fair agreement.

The optical relationships of the ethereal *l*-methoxysuccinates with the *d*-dimethoxysuccinates (*Trans.*, 1901, **79**, 963), in the pure liquid state and in solution, are pointed out, also the relationships of these esters with the parent malates and tartrates.

The diamide and dianilide of *l*-methoxysuccinic acid were prepared, and their rotatory powers in solution compared with those of maldiamide and maldianilide in similar solvents.

209. "Optically active derivatives of *l*-methoxy- and *d*-dimethoxysuccinic acids." By Thomas Purdie and Charles Robert Young. (Trans., 1910, 1524).

The authors have prepared further derivatives of these acids, including the anhydrides and dichlorides. Polarimetric examination of the latter afforded no evidence that they were mixtures of two tautomeric forms of the type frequently assigned to succinyl chloride. The molecular rotations of *l*-methoxysuccinic acid and a number of its derivatives approximate to the halved values of the corresponding dimethoxy-compounds. It is pointed out that the movements of rotation attending the conversion of alkyloxy-, acyloxy-, and halogen-succinic acids of *d*- and *l*-configuration into chloride, ester, and anhydride are always in the dextro- and lævo-direction respectively, irrespective of the sign of rotation of the initial acid.

The action of sodium methoxide on methyl *l*-methoxysuccinate gave an optically inactive condensation compound, apparently identical with a substance obtained similarly (*Trans.*, 1891, **59**, 472) from methyl fumarate. The products of the action of magnesium methyl iodide and of magnesium phenyl bromide on methyl *d*-dimethoxysuccinate were *γδ-dimethoxy-βε-dimethylhexane-βε-diol* (m. p. 71°) and 3 : 4-*dimethoxy*-2 : 2 : 5 : 5-*tetraphenyltetrahydrofuran* (m. p. 185°) respectively; both compounds are lævorotatory.

210. "Action of Grignard reagents on methyl *l*-methoxysuccinate methyl maleate, and maleic anhydride." By Thomas Purdie and Paul Seidelin Arup. (Trans., 1910, 1537).

The action of magnesium methyl iodide on methyl *l*-methoxysuccinate is similar to that of the same reagent on the *d*-dimethoxyester previously described, the product being optically active γ-methoxy-βε-dimethylhexane-βε-diol. Dehydration, however, occurred in the course of isolating the compound by distillation, and the final product obtained was the oxide of the glycol, or possibly an isomeric unsaturated alcohol. The substance is dextrorotatory.

Two crystalline compounds were isolated from the product of the action of magnesium phenyl bromide on methyl *l*-methoxysuccinate, namely, 2:2:5:5-*tetraphenyl*-2:5-*dihydrofuran* (m. p. 190—191°) and a *triphenylbutyrolactone* (m. p. 160—161°), both optically inactive. The latter compound, on being heated with mineral acids, was converted into an isomeric lactone (m. p. 197°). With the view of elucidating the reactions concerned in the production of these compounds, the authors examined the action of magnesium phenyl bromide on methyl fumarate and maleate and on maleic anhydride. The product in the case of methyl fumarate was an uncrystallisable oil from which no pure substance could be isolated. Methyl maleate gave the above-mentioned dihydrofuran derivative, and maleic anhydride gave A. Smith's desylacetophenone (*Trans.*, 1890, **57**, 643).

211. "The intramolecular rearrangement of diphenylamine orthosulphoxides. Part III. The tri- and tetra-chlorosulphoxides." By Oscar Lisle Brady and Samuel Smiles. (Trans., 1910, 1559).

In a previous paper the mechanism of this rearrangement was discussed, and the hypothesis was advanced that it depends on the preliminary formation of a salt of the sulphoxide. The tri- and tetrachloro-sulphoxides of diphenylamine have now been prepared by the action of hydrogen dioxide and hydrochloric acid on thiodiphenylamine, and these have been fully investigated with the object of isolating their salts. This has been accomplished in the case of the trichloro-derivative, the hydrochloride of which is readily converted into the azothionium compound by warming in certain media. It is considered that the explanation previously given to this reaction is thus confirmed.

212. "The rate of hydration of acid anhydrides: succinic, methylsuccinic, itaconic, maleic, citraconic, and phthalic." By Albert Cherbury David Rivett and Nevil Vincent Sidgwick. (Trans., 1910, 1677).

The authors have investigated the rate of hydration of these anhydrides by means of the conductivity, by a method described for acetic anhydride in a previous paper (*Trans.*, 1910, **97**, 732). In all cases the reaction was found to be unimolecular, and not to be catalysed by hydrogen ions. The slight variation of the rate with concentration, previously found with acetic anhydride, was not observed with any of these cyclic anhydrides, with the possible exception of methylsuccinic. The velocities are given below (the mean value for acetic anhydride being added for comparison), together with the dissociation constants of the corresponding acids:

Anhydride.	Velocity constant.		Dissociation constant of acid.	
	Absolute.	Relative.	Absolute.	Relative.
[Acetic	0·001148	0·99]		
Succinic	0·001155	1·00	0·0066	1·00
Methylsuccinic	0·001609	1·39	0·0086	1·30
Itaconic (Methylenesuccinic)	0·001294	1·12	0·012	1·82
Maleic	0·0115	9·96	1·2	182
Citraconic (Methylmaleic)	0·00765	6·62	0·34	51·5
Phthalic	0·00461	3·99	0·121	18·3

It will be seen that succinic anhydride, with its saturated, five-membered ring, which on Baeyer's theory has practically no strain, is hydrated with almost the same velocity as the open-chain acetic anhydride. The velocity is greatly increased by a double link, less by a benzene link. With the exception of methylsuccinic anhydride, the order of the velocities is the same as that of the dissociation constants. The introduction of a methyl group raises the velocity of succinic anhydride and lowers that of maleic; it has the same effect on the dissociation constants of the corresponding acids.

213. "Ethyl 6-methyl-2-pyrone-3:5-dicarboxylate and its conversion into methyltrimesic acid." By John Lionel Simonsen. (Trans., 1910, 1910.)

Ethyl 6-methyl-2-pyrone-3:5-dicarboxylate (*Trans.*, 1908, **98**, 1022), on hydrolysis, is converted into *methyltrimesic acid*, which on oxidation gives prehnitic acid. The condensation of ethyl propiolate and ethyl acetoacetate was also investigated.

214. "**The action of bases on $\alpha\beta$-dibromobutyric acid and its esters.**" **By Thomas Campbell James.** (Trans., 1910, 1565).

The action of various alkalis, tertiary bases, and alkaloids in abstracting hydrogen bromide from $\alpha\beta$-dibromobutyric acid has been examined. The reaction of the acid with aqueous potassium hydroxide has been followed kinetically and shown to be strictly bimolecular.

In the case of all the bases used, the product consists of a mixture of α-bromo- and α-bromo*allo*-crotonic acids, the proportion of the former being greater the weaker the base used.

When esters are used instead of the free acid, the proportion of α-bromo-acid is not increased to anything like the same degree as in the case of the analogous decomposition of $\alpha\beta$-dibromo-β-phenylpropionic acid (cinnamic acid dibromide).

215. "**The absorption spectra of furan, furfuraldehyde, thiophen, and pyrrole under different conditions.**" **By John Edward Purvis.** (Trans., 1910, 1648).

The results of the investigation are: (1) The vapour of furan exhibits absorption bands, some of which are similar in appearance and have similar differences in wave-lengths; the vapour of furfuraldehyde also exhibits bands which can be grouped together, but which are different from those of furan; the vapours of thiophen and pyrrole show a few bands, two of which are comparable with two in the vapours of furan and of furfuraldehyde. (2) Alcoholic solutions of furan, thiophen, and pyrrole show no absorption bands, whilst a $N/1000$-solution of furfuraldehyde shows a strong band in the ultra-violet. (3) The liquids, furfuraldehyde, thiophen, and pyrrole, show no absorption bands.

216. "**The viscosity of certain amides.**" **By Albert Ernest Dunstan and Albert George Mussell.** (Trans., 1910, 1935).

The authors have determined the viscosities of a considerable number of amides in the free state in aqueous solution and in pyridine solution. They find that in aqueous solution the simple fatty amides are still associated to a considerable extent, and that formamide is largely dissociated. The amides in the fused condition are associated, but whilst acetanilide has a high molecular viscosity, pointing to great association, methylacetanilide exists in a much more simple molecular condition. In pyridine solution the amides show little signs of the acidic character which would be

expected did they possess the hydroxyiminic structure. With the exceptions of thiocarbamide, diphenylthiocarbamide, and cyanuric acid, the molecular viscosities are normal.

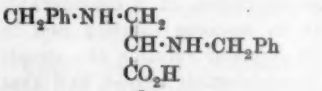
217. "Changes in volume in the formation of dilute solutions. Part II. Relationship between change in volume and constitution." By Harry Medforth Dawson. (Trans., 1910, 1896).

It is shown that the change in volume which accompanies the formation of dilute solutions of a given substance in a series of solvents is determined by the internal pressures and the compressibilities of the solvents provided that the formation of the solution is unaccompanied by changes in the degree of complexity of the solute and solvent, and that the two kinds of molecules do not enter into combination. Such solutions are termed "normal" solutions. Experimental observations relating to iodine solutions indicate that combination between iodine and the solvent is of frequent occurrence. Since this combination is accompanied by an alteration in volume, the observed changes in volume in the formation of iodine solutions are not as a rule in agreement with the requirements of the equation deduced for "normal solutions." In some few cases, however, the relative volume changes are such as are anticipated by theory.

The absence of parallelism in the volume changes when two substances are dissolved in the same series of solvents is also consistent with the view that solvates are usually formed in dilute solutions.

218. "αβ-Dibenzylaminopropionic acid and 1:7-dibenzyltetrahydrouric acid." By Edward Percy Frankland. (Trans., 1910, 1686).

Following the method adopted by the author in the recent synthesis of tetrahydrouric acid, a dibenzyltetrahydrouric acid was prepared by the action of cyanic acid on *αβ-dibenzylaminopropionic* acid (I), one of the carbamide groups being condensed with the carboxyl group by means of 25 per cent. hydrochloric acid:



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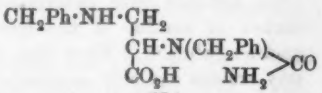

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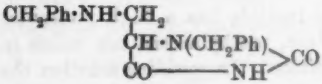

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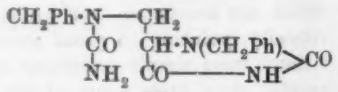


(IV.)

The first product of the action of cyanic acid on the dibenzylaminopropionic acid was probably *β-benzylamino-α-benzylcarbamidopropionic acid* (II) (m. p. 200—201°), which was condensed with hydrochloric acid to *β-benzyl-γ-benzylaminomethylhydantoin* (III) (m. p. 112—115°). One of the benzylamino-groups remained unacted on, and was capable of salt formation with a molecule of hydrochloric acid. The free base was converted into 1 : 7-*dibenzyltetrahydrouric acid* (IV) by prolonged heating with an excess of potassium cyanate in aqueous methyl alcohol; it forms prismatic crystals, melting with slight decomposition at 177—178° (uncorr.).

The *αβ*-dibenzylaminopropionic acid was obtained by boiling a solution of benzylamine in chloroform with *αβ*-dibromopropionic acid. The free dibenzylamino-acid is sparingly soluble in water with an alkaline reaction to litmus; it forms rhomboidal plates, melting and decomposing at 181—184° (uncorr.).

219. "**Contributions to the chemistry of the terpenes. Part VII. Synthesis of a monocyclic terpene from thymol.**" By **George Gerald Henderson and Maggie Millen Jeffs Sutherland.** (Trans., 1910, 1616).

From thymol, $C_6H_3MePr^{\beta}\cdot OH$, the authors prepared thymoquinone, which, on reduction with sulphuric acid, yielded thymoquinol, $C_6H_2MePr^{\beta}(OH)_2$. This dihydric phenol, when heated with hydrogen in presence of nickel according to the method of Sabatier and Senderens, was converted into the saturated disecondary alcohol, *menthane*-2 : 5-*diol*, $C_{10}H_{18}(OH)_2$. This compound forms very small, colourless crystals. It melts at 112° and boils at about 155°/15 mm. It is very readily soluble in alcohol, ether, or light petroleum, readily so in benzene, and very sparingly so in water. When heated at 110—200° with anhydrous potassium hydrogen sulphate, it yields a *terpene*, $C_{10}H_{16}$, which is a colourless liquid, boiling at 179°/760 mm. It has a rather faint odour somewhat like that of limonene, and is practically insoluble in water, but readily soluble in the usual organic solvents. It at once reduces permanganate, and unites additively with bromine, but apparently does not react with nitrous acid to form a nitrosite. It is probably $\Delta^{1:4}$-menthadiene, $\begin{matrix} CMe{:}CH\cdot CH_2 \\ | \\ CH_2\cdot CH{:}C\cdot CHMe_2 \end{matrix}$.

220. "**Contributions to the chemistry of the terpenes. Part VIII. Dihydrocamphene and dihydrobornylene.**" By **George Gerald Henderson and Ernest Ferguson Pollock.** (Trans., 1910, 1620).

When heated with hydrogen in presence of nickel according to the method of Sabatier and Senderens, bornylene, $C_{10}H_{16}$, is easily

converted into *dihydrobornylene*, $C_{10}H_{18}$, which appears to be identical with the saturated hydrocarbon camphane. When camphene, $C_{10}H_{16}$, is hydrogenated in a similar manner, the reaction is not so complete, and the nature of the product depends on the temperature. At 120—180° a solid product, melting at about 64°, was obtained, which by fractional crystallisation from methyl alcohol was proved to be a mixture of dihydrocamphene, $C_{10}H_{18}$, already prepared by Vavon (*Compt. rend.*, 1909, **149**, 997), with a small proportion of unchanged camphene. At a higher temperature a liquid was produced, which was also found to be a mixture, containing dihydrocamphene, a little unchanged camphene, and a small proportion of a third substance which was not further investigated. Dihydrocamphene, unlike dihydrobornylene, differs widely from camphane in melting point and other physical properties.

These results confirm the view that the arrangement of the carbon atoms in the molecule of bornylene is the same as in that of camphane, and that the structure of the molecule of camphene is of a different type.

221. "The oxidation of monohydric phenols with hydrogen peroxide." By George Gerald Henderson and Robert Boyd. (Trans., 1910, 1659).

A 30 per cent. aqueous solution of hydrogen peroxide has been found to be a good oxidising agent for monohydric phenols of the benzene series, the products being either a dihydric phenol, or a quinone, or even in some cases a tetrahydric phenol. From the results obtained with a number of phenols, it appears that those monohydric phenols in which the para-position relative to the hydroxyl group is unoccupied are most easily attacked by the oxidising agent, and yield as the main product either a *p*-dihydric phenol or a quinone according to the conditions of the experiment. On the other hand, those monohydric phenols in which the para-position relative to the hydroxyl group is occupied are not so easily oxidised, and usually yield dihydric phenols in which the hydroxyl groups are in the ortho-position to each other. Several new compounds were obtained.

Some experiments on the action of hydrogen peroxide on cyclic hydrocarbons were also made. The hydrocarbons of the benzene series which were examined appeared to be somewhat indifferent to the action of the oxidising agent, but naphthalene, anthracene, and phenanthrene were readily attacked, yielding phthalic acid, anthraquinone, and phenanthraquinone respectively.

222. **"Solubilities of organic substances in organic solvents, a contribution to the theory of solubility." By Dan Tyrer.** (Trans., 1910, 1778).

The solubility of a substance in a particular solvent is governed by two factors, namely, (1) the temperature, and (2) the concentration of the solvent, or the amount of solvent in unit volume of the saturated solution. Expressed mathematically, the solubility of a solute in a particular solvent under all possible conditions is given by the equation $S = K.f(C).\phi(T)$, where S is the solubility, C the concentration of the solvent, T the temperature, and K a constant. The object of the work was to determine the form of the function $f(C)$.

In order to avoid complications arising from the existence or formation of associated molecules in the solutions, the solubility of organic substances in organic solvents was studied. These were chosen also so as not to contain hydroxyl, amino- or cyanogen groups in order to minimise the possible formation of associated molecules. The method of attacking the problem was to find a solute soluble in a solvent A and insoluble in another solvent B, which is miscible with A in all proportions. The solubility of the solute in the mixed solvent is then determined, and the results are plotted against the concentration of the solvent in the saturated solution. Whilst some of the cases investigated give results which approximately represent the solubility at constant temperature as a linear function of the solvent concentration, the general conclusion deduced from the results is that no simple and common law governs the relation between the solubility and the concentration of the solvent.

Incidentally, determinations of the solubility of some organic substances in organic solvents were made at varying temperatures, and also of the concentrations of the solvents in the saturated solutions. It was noticed that in all the cases investigated the concentration of the solvent could be very approximately represented as a linear function of the temperature.

223. **"The chlorination of toluene." By Julius Berend Cohen, Harry Medforth Dawson, John Reginald Blockey, and Arnold Woodmansey.** (Trans., 1910, 1623).

Experiments have been made to determine the influence of various factors on the relative proportions of benzyl chloride and of *o*- and *p*-chlorotoluenes, which are obtained in the chlorination of toluene. The results indicate that side-chain substitution is favoured by

light and by rise of temperature, whereas nuclear substitution is favoured by the presence of small quantities of water and by adding to the toluene substances like nitrobenzene, which tend to promote the formation of polyhalogen compounds. Electrolytic chlorine behaves practically the same as ordinary chlorine.

In respect of the above-mentioned factors, the chlorination process appears to be influenced in the same way as the bromination process, and the view is adopted that side-chain substitution is effected by halogen molecules, whereas nuclear substitution is brought about by halogen which is combined with the halogen acid in the form of polyhalogen compounds. This theory has already been put forward by Holleman (*Proc. K. Akad. Wetensch. Amsterdam*, 1905, **8**, 512; *Rec. trav. chim.*, 1908, **27**, 435) to account for observations relating to the action of bromine on toluene.

A method for the analysis of mixtures of toluene, benzyl chloride, *o*-chlorotoluene, and *p*-chlorotoluene is described.

224. "The constitution of the benzenetetracarboxylic acids." By Hannah Bamford and John Lionel Simonsen. (Trans., 1910, 1904.)

A synthesis of Baeyer's mellophanic acid from 1 : 4-dimethylnaphthalene is described, and proof is adduced that the usual views on the constitution of mellophanic and prehnitic acids are incorrect. Prehnitic acid is 1 : 2 : 3 : 5-benzenetetracarboxylic acid, whilst mellophanic acid is the corresponding 1 : 2 : 3 : 4-compound.

225. "Action of light on the stereoisomeric piperonylideneacetones and on other unsaturated ketones." By Hans Stobbe and Forsyth James Wilson. (Trans., 1910, 1722.)

The authors have recently shown (*Annalen*, 1910, **374**, 237) that stereoisomeric ketones of the benzylidenedeoxybenzoin type, $Ar{\cdot}CH{:}CPh{\cdot}COPh$, can be converted into one another by the action of heat, small quantities of hydrochloric acid, or by direct sunlight, a state of equilibrium resulting. The two stereoisomeric piperonylideneacetones, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CH{\cdot}CO{\cdot}CH_3$ (Haber, *Ber.*, 1891, **24**, 618), have been investigated along similar lines, and similar results obtained.

It was next attempted to obtain the hitherto unknown stereoisomerides of anisylideneacetone, piperonylideneacetophenone, anisylideneacetophenone, and *o*-methoxybenzylideneacetophenone, but the experiments were unsuccessful. *Phenyl o-methoxystyryl ketone*, $MeO{\cdot}C_6H_4{\cdot}CH{:}CH{\cdot}COPh$, was obtained by condensing *o*-methoxybenzaldehyde and acetophenone by means of sodium hydroxide in alcoholic solution.

Doubly unsaturated ketones of the type of cinnamylideneacetophenone, CHPh:CH·CH:CH·COPh, are, by the action of sunlight, converted not only into stereoisomerides but also into polymerides.

226. **"*cyclo*Hexane, its separation from, and its estimation in, mixtures containing benzene." By Thomas Stewart Patterson and Alexander Fleck.** (Trans., 1910, 1773.)

A mixture of *cyclo*hexane and benzene may be separated by shaking with a small amount of ethyl tartrate, when the mixture separates into two layers. When a larger quantity of ethyl tartrate is added to the mixture a homogeneous solution results, and from the rotatory power of this the composition of the mixture can be determined by comparing the found rotatory power with that of mixtures of known composition.

227. **"The vapour pressures and molecular volumes of the mercuric halides and the relations between atomic volumes of elements before and after combination." By Edmund Brydges Rudhall Prideaux.**

The vapour pressures of the liquid compounds from their melting points to their boiling points have been determined. The temperatures of equal vapour pressures were compared with those of fluorobenzene by Ramsay and Young's method. If in the equation:

$$\frac{T'_A}{T'_B} = \frac{T_A}{T_B} + c(T'_B - T_B),$$

T_B and T'_B are the temperatures of fluorobenzene, $c(HgCl_2) = 0{\cdot}0005$, $c(HgBr_2) = 0{\cdot}00037$, and $c(HgI_2) = 0{\cdot}00025$. Trouton's constant for the boiling point under 760 mm. pressure was found to be:

$HgCl_2$, 24·1; $HgBr_2$, 23·9; HgI_2, 23·7.

The specific volumes of the liquids were measured in silica dilatometers—the expansion being represented by the following, where D_t = density at $t°$.

$HgCl_2$ (280—335°); $D_t = 4{\cdot}400 - 0{\cdot}002218\,(t - 280°)$.
$HgBr_2$ (240—340°); $D_t = 5{\cdot}116 - 0{\cdot}00338\,(t - 240°)$.
HgI_2 (255—355°); $D_t = 5{\cdot}238 - 0{\cdot}00322\,(t - 255°)$.

The ratios between the molecular volumes of the liquid compounds and the sums of the atomic volumes of the liquid elements, all measured at equal pressures of saturated vapour, are constant over the range of pressures investigated. These ratios are probably much the same as the ratios of the volumes of the atoms before and after combination. There is a slight expansion on combination which,

stated as the percentage increase on the volumes of the elements, is equal to:

For $HgCl_2$, 1·8; $HgBr_2$, 7·4; HgI_2, 9·5.

The numerical values of Trouton's constant and the expansions of the liquids show a slight association, diminishing in the order: chloride → bromide → iodide.

228. "A study of some unsaturated compounds containing the *tert.*-butyryl group. Part I." By Alfred Archibald Boon and Forsyth James Wilson. (Trans., 1910, 1751.)

The authors have investigated the action of bromine on *piperonylidenepinacoline*, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CH{\cdot}CO{\cdot}CMe_3$. This compound melts at 94—95°, and was obtained by the condensation of piperonal with pinacoline by means of sodium hydroxide. It gives an *oxime* (m. p. 144—145°), and, in chloroform solution, yields a *monobromide* (m. p. 110—111°), $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}CBr{\cdot}CO{\cdot}CMe_3$ (α-compound), or $CH_2{:}O_2{:}C_6H_3{\cdot}CBr{:}CH{\cdot}CO{\cdot}CMe_3$ (β-compound), and also a *dibromide*, $CH_2{:}O_2{:}C_6H_3{\cdot}CHBr{\cdot}CHBr{\cdot}CO{\cdot}CMe_3$, which melts at 138—139°, and is the chief product of the reaction.

When absolute alcohol was allowed to act on the latter, a substance was obtained identical with that produced when the dibromide, in alcoholic solution, was treated with potassium hydroxide (1 mol.). This product, which melts at 82—83°, may be represented either as $CH_2{:}O_2{:}C_6H_3{\cdot}CHBr{\cdot}CH(OEt){\cdot}CO{\cdot}CMe_3$ (α) or $CH_2{:}O_2{:}C_6H_3{\cdot}CH(OEt){\cdot}CHBr{\cdot}CO{\cdot}CMe_3$ (β).

As a result of the action of potassium hydroxide (2 mols.) on the dibromide (m. p. 138—139°) in alcoholic solution, the authors obtained a compound identical with that already referred to, melting at 82—83°, and two ethoxy-derivatives of piperonylidenepinacoline, $CH_2{:}O_2{:}C_6H_3{\cdot}CH{:}C(OEt){\cdot}CO{\cdot}CMe_3$ (α) and $CH_2{:}O_2{:}C_6H_3{\cdot}C(OEt){:}CH{\cdot}CO{\cdot}CMe_3$ (β), melting at 86—87° and 112—113° respectively. These compounds may, however, be stereoisomeric.

229. "A new method for the preparation of aryl ethers of glycerol α-monochlorohydrin." By David Runciman Boyd and Ernest Robert Marle. (Trans., 1910, 1788.)

The aryl ethers of glycerol α-monochlorohydrin are conveniently prepared by leaving a mixture of the phenol, epichlorohydrin, and a small quantity of sodium hydroxide for some days at the ordinary temperature. *γ-Chloro-β-hydroxy-α-o-tolyloxypropane* (b. p. 166°/18 mm.) and the corresponding *p*-tolyl compound (b. p. 165°/

14 mm.) have been prepared. The phenylurethane of *γ-chloro-β-hydroxy-α-phenoxypropane* melts at 70°, and the phenylurethanes of the *o-tolyloxy-* and *p-tolyloxy*-compounds at 80—81° and 113—114° respectively.

230. **"The action of ammonia on the glycide aryl ethers. Part II. Phenoxypropanolamines." By David Runciman Boyd.** (Trans., 1910, 1791.)

The constitution previously assigned to the primary base derived from *o*-tolyl glycide ether, $C_7H_7{\cdot}O{\cdot}CH_2{\cdot}CH(OH){\cdot}CH_2{\cdot}NH_2$, has been confirmed by the preparation of the same substance from γ-chloro-β-hydroxy-α-*o*-tolyloxypropane and ammonia.

Phenyl glycide ether, when treated with a solution of ammonia in 50 per cent. alcohol, gives a primary *base*, $C_6H_5{\cdot}O{\cdot}CH_2{\cdot}CH(OH){\cdot}CH_2{\cdot}NH_2$ (m. p. 97—98°), and a secondary *base*, $[C_6H_5{\cdot}O{\cdot}CH_2{\cdot}CH(OH){\cdot}CH_2]_2NH$ (m. p. 101—102°).

231. **"The relation of position isomerism to optical activity. Part VIII. The rotation of the menthyl esters of the alkyloxy- and alkylamino-derivatives of benzoic acid." By Julius Berend Cohen and Harold Ward Dudley.** (Trans., 1910, 1732.)

The present investigation is a continuation of former studies on the same subject, and deals with substituted menthyl benzoates containing positive in place of negative groups. Ten series of isomeric esters have been prepared, and their rotational values ascertained. The authors find that temperature is an important factor in such determinations. Whilst the temperature-coefficient for the ortho-compounds is small and in nearly all cases positive, that of the para-compounds is large and negative, the intermediate meta-compounds being small and also negative. It follows that if a comparison of the three isomerides is made at 100° instead of 20°, the rotational values of the meta- and para-isomerides approximate to that of the unsubstituted menthyl benzoate at the same temperature, whereas the value of the ortho-compound is widely divergent. The general rule which was previously established in the case of the halogen, nitro- and nitro-halogen derivatives applies with equal truth to the menthyl esters containing positive groups, namely, *the ortho-substituent exerts a preponderating effect on the rotational value of the active group.*

232. "The volatile constituents of coal." By Maurice John Burgess and Richard Vernon Wheeler. (Trans., 1910, 1917.)

It is shown that with all coals, whether bituminous, semi-bituminous, or anthracitic, there is a well-defined decomposition-point at a temperature lying between 700° and 800°, which corresponds with a marked increase in the quantity of hydrogen evolved. With bituminous coals, the increase in the quantity of hydrogen evolved falls off at temperatures above 900°, but with anthracitic coals it is maintained up to 1100°.

It is further shown that ethane, propane, and butane, and, probably, higher members of the paraffin series of hydrocarbons, form a large percentage of the gases evolved at low temperatures, but that at temperatures above 700° the evolution of such hydrocarbons practically ceases.

The suggestion is advanced that coal of whatever geological age contains a compound which undergoes decomposition at temperatures above 700° (under the atmospheric pressure), and yields hydrogen as its principal gaseous product. It seems probable, also, that the same compound is responsible for the hydrocarbons of the paraffin series that make their appearance at low temperatures.

238. "Tetramethyl ferrocyanide and some derivatives." By Ernald George Justinian Hartley. (Trans., 1910, 1725.)

Experiments have been made in continuation of the work recently published (*Trans.*, 1910, **97**, 1066) on the reaction between potassium ferrocyanide and methyl sulphate.

By taking care to exclude moisture as far as possible, the reaction followed a somewhat different course, and a neutral *methyl sulphate*, $(CH_3)_6FeC_6N_6(CH_3{\cdot}SO_4)_2$, was isolated of the same base, the acid salts of which had been previously obtained. Unlike the acid methyl sulphate, this salt does not undergo any change on keeping in a vacuum over sulphuric acid. In addition to this, there were formed some of the acid sulphate previously described and another neutral salt of the same base, probably the ethyl sulphate. The neutral sulphate, $(CH_3)_6FeC_6N_6SO_4$, can be prepared from the acid sulphate by neutralising with barium hydroxide in aqueous solution, removing barium sulphate, and evaporating the filtrate in a vacuum. It is an unstable substance, differing from the acid salt in being soluble in ethyl alcohol. The corresponding chloride is prepared by neutralising with barium hydroxide as above, and then adding excess of barium chloride and

evaporating to dryness. The salt is extracted from the excess of barium chloride with alcohol and precipitated with ether. It is far more stable than the sulphate.

On heating the chloride under diminished pressure to 140°, methyl chloride is given off quantitatively, and almost pure tetramethyl ferrocyanide is left. This resembles the corresponding ethyl compound prepared from silver ferrocyanide and ethyl iodide in being soluble in chloroform and water, and giving in aqueous solution a white precipitate with mercuric chloride and a reddish-purple coloration with ferric chloride. It is deposited from chloroform in well-formed crystals containing chloroform of crystallisation.

234. **"The molecular complexity of amides in various solvents. Part II." By Andrew Norman Meldrum and William Ernest Stephen Turner.** (Trans., 1910, 1605.)

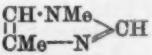
In continuation of their previous work (*Trans.*, 1908, **93**, 876) the authors have determined the molecular complexity of seventeen additional amides in the same organic solvents as before. The principal object of the work was to test the Nernst-Thomson hypothesis, that association of the solute tends to be high when the dielectric constant of the solvent is low, and vice versa. They regard their results as in good agreement with the hypothesis. The following table summarises the results (for organic solvents) of both investigations, and includes the dielectric constants of the solvents:

Solvent.	Alcohol.	Acetone.	Chloroform.	Ether.	Benzene.
No. of amides investigated	28	27	22	14	21
No. of amides which form simple molecules	24	20	3 and 1 doubtful	3 and 2 doubtful	3 and 1 doubtful.
No. of amides which form associated molecules	1 and 3 doubtful	4 and 3 doubtful	18	9	17
Dielectric constant	25·4 at 18·5°	21·2 at 22°	5 at 22°	4·4 at 18°	2·3 at 18°

235. **"The tautomerism of glyoxalines and the constitution of pilocarpine." By Frank Lee Pyman.** (Trans., 1910, 1814.)

Otto Fischer (*J. pr. Chem.*, 1906, [ii], **73**, 419; 1907, [ii], **75**, 88) has already shown that benziminazoles are tautomeric, and Jänecke (*Ber.*, 1899, **32**, 1098) and Gabriel (*Ber.*, 1908, **41**, 1926) have made it seem probable that simple glyoxalines behave similarly. Conclusive evidence that simple glyoxalines react as tautomeric compounds is now brought forward, for it is found that 4(or 5)-methylglyoxaline yields on methylation a mixture of

the two isomerides, 1 : 4-*dimethylglyoxaline* (I) (b. p. 198—199°) and 1 : 5-*dimethylglyoxaline* (II) (b. p. 224—225°):



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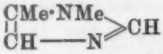


(II.)

Jowett and Potter (*Trans.*, 1903, **83**, 464) by the methylation of 4(or 5)-methylglyoxaline obtained a dimethylglyoxaline which they regarded as a simple substance, but which was not identical with the dimethylglyoxaline obtained by Jowett (*Trans.*, 1903, **83**, 438) from *iso*pilocarpine. It is now shown that the latter compound is identical with 1 : 5-dimethylglyoxaline, and that Jowett and Potter's dimethylglyoxaline was a mixture of the 1 : 4- and 1 : 5-isomerides, consisting mainly of the former.

The methylation of *bromo*-4(or 5)-*methylglyoxaline* and *dibromo*-4(or 5)-*methylglyoxaline* yields in each case a mixture of two isomeric N-*methyl* derivatives which have been separated and characterised. The bromination of 1 : 4- and 1 : 5-dimethylglyoxaline leads to the formation of one of the bromodimethylglyoxalines and one of the dibromodimethylglyoxalines in each case.

236. "Kinetics of the reaction between silver salts and aliphatic iodides." By Frederick George Donnan and Harold Edward Potts. (Trans., 1910, 1882.)

The experiments of Burke and Donnan (*Trans.*, 1904, **85**, 555) have shown that the reaction between silver nitrate and an alkyl iodide in alcoholic solution is disturbed by an accelerating effect due to one of the products. In the present paper it is shown that in the reaction between silver lactate and ethyl iodide in aqueous alcohol, the accelerating effect disappears. It is also shown that in the reaction between silver nitrate and ethyl iodide in a non-hydroxylic solvent (acetonitrile) when no free (nitric) acid is produced, the kinetic behaviour does not essentially differ from that observed in alcoholic and aqueous solutions. The reaction between iodoform and silver nitrate in alcoholic solution follows the same pseudo-bimolecular equation as the reaction between a mono-iodide and silver nitrate. It was found that methylene iodide reacts very sluggishly with silver nitrate in alcoholic solution. Owing to the rapid decomposition of carbon tetraiodide in alcoholic solution, comparative experiments with this substance could not be carried out with sufficient accuracy. Although the matter could not be decisively settled, the general trend of the experimental evidence is in favour of the view that it is the undissociated silver salt which reacts with the alkyl iodide in the first instance, with the formation,

possibly, of a transient intermediate product. The suggestion is made that the constancy of the velocity-coefficient in any particular reaction is due to a compensation of the decrease due to the increasing relative ionisation of the silver salt by the acceleration referred to above. Senter's suggestion that the acceleration is due to the silver halide produced is discussed.

237. **"The identity of osyritrin, myrticolorin, violaquercitrin, and rutin." By Arthur George Perkin.** (Trans., 1910, 1776.)

It has been shown (*Trans.*, 1902, **81**, 477) that osyritrin, myrticolorin, and violaquercitrin are identical. Schmidt (*Arch. Pharm.*, 1908, **246**, 214) and Wunderlich (*ibid.*, **246**, 224) have found that when hydrolysed violaquercitrin gives, in addition to quercetin and dextrose, also rhamnose, and that this glucoside is identical with rutin, which yields the same products. It therefore appeared certain that osyritrin and myrticolorin in reality consist of rutin, and this has been found to be the case.

238. **"A glucoside from Tephrosia purpurea." By George Clark, jun., and Shrish Chandra Banerjee.** (Trans., 1910, 1833.)

Tephrosia purpurea (Pers.), nat. ord. *leguminosae*, contains a yellow, crystalline glucoside (Clarke and Banerjee, *Proc.*, 1909, **25**, 16). This substance has been further investigated, and has the formula $C_{27}H_{30}O_{16},3H_2O$. When hydrolysed, it is decomposed into quercetin, dextrose, and rhamnose according to the equation $C_{27}H_{30}O_{16}+3H_2O=C_{15}H_{10}O_7+C_6H_{12}O_6+C_6H_{12}O_5,H_2O$.

It is identical with rutin described by Schunk (*Trans.*, 1888, **53**, 264), which therefore has the above formula, and not that hitherto ascribed to it.

239. **"The molecular complexity of amides in various solvents. Part III. Amides in aqueous solution." By Andrew Norman Meldrum and William Ernest Stephen Turner.** (Trans., 1910, 1805.)

In continuation of their previous work (Trans., 1908, **93**, 876; 1910, **97**, 1605) the authors have determined the molecular complexity of fourteen additional amides in aqueous solution. Water, by reason of its high dielectric constant, should prevent association of the solute, according to the Nernst-Thomson rule. The authors find that fifteen out of the total of twenty-three amides examined are associated in water.

The authors hold that association in water is of frequent occur-

rence, and has been ignored in the study of aqueous solutions to an injurious extent. They find that during the hydrolysis of ethyl acetate, or the inversion of sucrose, by hydrochloric acid, the presence of methylacetanilide, an associated substance, has an effect similar to that caused by the presence of sodium chloride, as observed by Caldwell (*Proc. Roy. Soc.*, 1906, **78**, *A*, 272) and H. E. Armstrong (*loc. cit.*, 1907, **79**, *A*, 576). The accelerations due to equal weights of the two foreign substances are approximately the same.

240. "Optically active salts of 4-oximino*cyclo*hexanecarboxylic acid and the configuration of the oximino-group." By William Hobson Mills and Alice Mary Bain. (Trans., 1910, 1866.)

If morphine (1 mol.) is added to the ethyl-alcoholic solution of 4-oximino*cyclo*hexanecarboxylic acid, the morphine salt which separates contains a dextrorotatory form of the acid, for on decomposing it with excess of ammonia and removing the morphine, the solution of ammonium salt obtained is strongly dextrorotatory, the molecular rotation varying from $[M]_D$ 50° to $[M]_D$ 60° in different preparations. Similarly, from the quinine salt (*Proc.*, 1909, **25**, 178), which has been crystallised from water, the corresponding lævorotatory ammonium salt, $[M]_D$ −70° to −80°, has been obtained. That the substances to which these optically active solutions of ammonium salt owe their rotatory power are the normal ammonium salts of dextro- and lævo-rotatory forms of 4-oximino-*cyclo*hexanecarboxylic acid was shown by treating the solutions with silver nitrate. The substances thus precipitated were pure silver salts of this acid, and when treated with an aqueous solution of sodium chloride they gave respectively dextro- and lævo-rotatory solutions of the corresponding sodium salts, the molecular rotations observed being $[M]_D$ 74·5° and −79·9°. Autoracemisation takes place very rapidly in neutral solutions of these optically active salts, but it is greatly retarded by the presence of excess of alkali.

By these experiments the existence of a new type of optically active substances is demonstrated, the molecular asymmetry of which is determined by the peculiar configuration of the doubly linked tervalent nitrogen atom. In addition, direct proof is afforded that in the oximino-group the three valencies of the nitrogen atom are directed along the three edges of a trihedral angle, as was postulated by Hantzsch and Werner (*Ber.*, 1890, **23**, 11).

241. "The resolution of benzoyloscine." By Frank Tutin. (Trans., 1910, 1793.)

Benzoyloscine (benzoylscopoline) has been resolved by the fractional crystallisation of its d-*bromocamphorsulphonate*. *Benzoyl*-d-*oscine* d-*bromocamphorsulphonate* forms needles, which melt at 246°, but *benzoyl*-l-*oscine* d-*bromocamphorsulphonate* could not be obtained in a state of purity. *Benzoyl*-d-*oscine hydrochloride* melts at 283—284°; the corresponding *nitrate* at 200°; the *picrate* at 211—212°; and the *aurichloride* at 189—190°.

Benzoyl-d-*oscine* has $[\alpha]_D$ +3·5° in 50 per cent. alcohol, whilst the ion of this base has $[\alpha]_D$ +10·0°, calculated from the rotation of its *d*-bromocamphorsulphonate.

d-*Oscine* was prepared in the form of its *hydrochloride* by hydrolysing benzoyl-*d*-oscine with hydrochloric acid. It has a specific rotation of about +77·7°.

Benzoyloscine d-*camphorsulphonate* melts at 167—168°, and forms microscopic, diamond-shaped crystals, but it could not be resolved by fractional crystallisation.

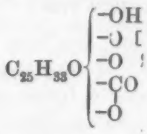
242. "Carboxylic acids of *cyclo*hexanone and some of its derivatives." By Henry Dent Gardner, William Henry Perkin, jun., and Hubert Watson. (Trans., 1910, 1756.)

A detailed account of an investigation of which a preliminary note has already appeared (this vol., p. 136).

243. "Note on the constitution of α-elaterin." By Charles Watson Moore. (Trans., 1910, 1797.)

The following formulæ have, at various times, been suggested for elaterin: $C_{20}H_{28}O_5$ (Zwenger); $C_{22}H_{30}O_6$ (Thoms); $C_{24}H_{34}O_6$ (Hemmelmayr); and $C_{28}H_{38}O_7$ (Berg). The present author has now obtained results which prove the correctness of the empirical formula suggested by Berg. The presence of an acetyl group in elaterin has been confirmed, but it has been shown that this substance contains no ketonic or aldehydic group. Two crystalline substances have been obtained by the oxidation of "elateric acid," which have been shown to possess the formulæ $C_{24}H_{32}O_4$ and $C_{24}H_{30}O_5$ respectively. The latter of these is a diketone, and has been designated *elaterone*. On distillation with zinc dust, elaterin yields 1 : 4-dimethylnaphthalene.

The results so far obtained indicate that the formula of elaterin may be represented as follows:



244. "The viscosity of salt solutions."
By Malcolm Percival Applebey. (Trans., 1910, 2000.)

By the use of specially standardised viscometers of a modified Ostwald type, the viscosities of aqueous solutions of lithium nitrate have been determined at 25°, 18°, and 0° over wide ranges of concentration with an error of not more than 0·01 per cent. for solutions less concentrated than normal.

The formula of Grüneisen (*Wiss. Abh. Phys.-Tech. Reichs.*, 1905, **4**, 151) is found not to represent the phenomena of dilute solution. A method of calculating the viscosity of salt solutions from their hydration numbers, or vice versa, has been described. The application of this method to the viscosities of solutions of lithium nitrate at 18° and 25° gives results consistent with the estimates of ionic hydration made by other observers. The application of the method to some other salts is discussed.

245. "Some reactions of keten. Combination with hydrocyanic acid."
By Stella Deakin and Norman Thomas Mortimer Wilsmore.
(Trans., 1910, 1968.)

The compound which was mentioned (*Proc.*, 1908, **24**, 77) as being formed by the action of keten on hydrocyanic acid has been further investigated. In a pure state it is a colourless liquid, which boils undecomposed at 110·2°(corr.)/100 mm., and with slight decomposition at 173°/772 mm. It may be frozen to a white solid, which melts at −196° to −195°. Analysis and determination of molecular weight show that it has the composition $C_5H_5O_2N$. The new substance is decomposed by water with formation of acetic and hydrocyanic acids, and by alcohol in the presence of mineral acids, ethyl acetate and hydrocyanic acid being obtained. It also reacts with aniline, giving acetanilide and hydrocyanic acid. It is tentatively suggested that the new compound may be *α-acetoxyacrylonitrile*, $CH_2{:}C(CN)\cdot O\cdot CO\cdot CH_3$, a constitution which is shown to be consistent with the molecular volume, refractivity, and dispersion of the substance.

The actions of magnesium methyl iodide and of nitrosyl chloride

on keten have also been studied. With the former acetone is produced, and with the latter chloroacetyl chloride; but in both cases the greater part of the keten condenses with the formation of brown resins.

246. **"The polymerisation of keten. *cyclo*Butan-1:3-dione ('acetylketen')." By Frances Chick and Norman Thomas Mortimer Wilsmore.** (Trans., 1910, 1978.)

The research on the polymerisation of keten (*Trans.*, 1908, **93**, 946) has been continued, and the first or bimolecular polymeride has been more fully studied. This substance combines with bromine to form a bromoacetoacetyl bromide, which with alcohol gives γ-bromoacetoacetic ester and not the α-derivative, showing conclusively that the bimolecular polymeride is *cyclo*butan-1:3-dione and not acetylketen, as previously supposed. From the bromoacetoacetyl bromide, an anilide was also obtained, identical with the bromoacetoacetanilide described by Knorr (*Annalen*, 1886, **236**, 79), which shows that the bromine in this substance is in the γ- and not in the α-position, as believed by him. As a further consequence, the bromohydroxymethylquinoline, obtained by Knorr by the action of sulphuric acid on bromoacetoacetanilide, would seem to have the bromine attached to the methyl group and not to the nucleus, or else the bromine atom must wander from the methyl to the CH_2 group during the condensation. With ammonia, *cyclo*butan-1:3-dione forms, in the first place, the acetoacetamide described by Claisen and Meyer (*Ber.*, 1902, **35**, 583); but by the further action of ammonia an oil is obtained, which appears to consist chiefly of aminocrotonamide, since on heating it gives a compound having the composition $C_8H_{13}O_2N_3$, which is in all probability a lutidine derivative, namely, *4-amino-2:4-dimethyl-Δ^2-tetrahydro-6-pyridone-3-carboxylamide*. With semicarbazide, *cyclo*butan-1:3-dione forms the semicarbazone-semicarbazide of acetoacetic acid. With magnesium methyl iodide, diacetone alcohol appears to be formed in small quantity. With hydrogen in presence of platinum black, *cyclo*butan-1:3-dione is reduced to butyraldehyde. It does not react with sodium, with phenylcarbimide, or with hydrocyanic acid. On long keeping, or on warming, it polymerises with formation of dehydracetic acid.

Much work has been done with a view to elucidating the nature of the yellow, crystalline compound, which is formed from *cyclo*butan-1:3-dione in the presence of quinoline; but so far no clue to its constitution has been found. Its empirical formula is, however, $C_{13}H_{10}O_3$. It is possibly a naphthalene derivative.

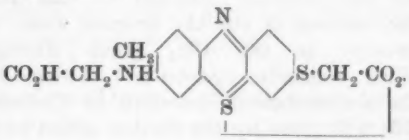
247. "Aromatic antimony compounds. Part I. The oxidation and nitration of triphenylstibine." By Percy May. (Trans., 1910, 1956.)

A description is given of the nitration of triphenylstibine, a preliminary account of which has already appeared (this vol., p. 142). The behaviour of triphenylstibine towards various oxidising agents, such as concentrated sulphuric acid, and potassium permanganate, is described, and the relation between various derivatives of triphenylstibine oxide, and the influence of the nitro-group in the molecule are also discussed.

248. "Contributions to our knowledge of the sulphide dyestuffs. Part I." By George Herbert Frank.

It has been found that many colouring matters belonging to the "sulphide" class readily combine with chloroacetic acid, giving carboxylic derivatives which are readily soluble in alkalis.

The colouring matter known as immedial-indone gives a dicarboxylic derivative, $C_{17}H_{14}O_4N_2S_2$ (Found, M.W. = 377), which requires, for its reduction to the leuco-compound, two atoms of hydrogen per molecule. The suggested constitution for this dicarboxylic derivative is:



249. "The constituents of leptandra." By Frederick Belding Power and Harold Rogerson. (Trans., 1910, 1944.)

The material employed for this investigation was commercial "leptandra," consisting of the dried rhizome and roots of *Veronica virginica*, Linné (*Leptandra virginica*, Nuttall).

A concentrated alcoholic extract of this material, when distilled in a current of steam, yielded a small amount of an essential oil. The latter was a dark-coloured liquid, which distilled between 120° and 160°/25 mm.

The portion of the extract which was soluble in water contained 3:4-dimethoxycinnamic acid, $C_6H_3(OMe)_2\cdot CH{:}CH\cdot CO_2H$ (m. p. 180—181°); a quantity of mannitol, amounting to 2·14 per cent. of the weight of the drug; and a sugar which yielded *d*-phenylglucosazone (m. p. 209—211°), together with tannic and colouring matter. It yielded, furthermore, a quantity of an amorphous

product, which possessed an intensely bitter, nauseous taste, and amounted to 1·6 per cent. of the weight of the drug. By the hydrolysis of this product there were obtained, besides resinous material, cinnamic and *p*-methoxycinnamic acids.

The portion of the extract which was insoluble in water consisted chiefly of a dark brown resin, which amounted to 6·2 per cent. of the weight of the drug. From this resin the following substances were obtained: a phytosterol, $C_{27}H_{46}O$ (m. p. 135—136°; $[\alpha]_D$ −33·0°), the acetate of which melts at 119—120°, and which it is proposed to designate *verosterol*; a mixture of fatty acids, consisting apparently of oleic, linolic, palmitic, and stearic acids; *p*-methoxycinnamic acid, $OMe{\cdot}C_6H_4{\cdot}CH{:}CH{\cdot}CO_2H$ (m. p. 170°), which was present in the form of an ester, and a very small amount of 3 : 4-dimethoxycinnamic acid.

It has not been possible to confirm the statement recorded in the literature that "leptandra" contains a crystalline, bitter glucoside, designated as "leptandrin," to which its activity may be attributed, nor does it contain a saponin, as has been asserted.

250. "The formation of tolane derivatives from *p*-chlorotoluene and 3 : 4-dichlorotoluene." By James Kenner and Ernest Witham. (Trans., 1910, 1960.)

The anomalous formation of a tolane derivative during the preparation of benzotrichloride from toluene, described by Liebermann and Homeyer (*Ber.*, 1879, **12**, 1971), was also observed by Armstrong and Wynne during the conversion of *p*-chlorotoluene and of 3 : 4-dichlorotoluene into the corresponding chlorobenzylidene dichlorides. The present authors have investigated these toluene derivatives with the view of determining the conditions leading to their formation.

To aid in the study of this condensation, 4 : 4′-dichlorotolane tetrachloride has been obtained by the action of copper powder on *p*-chlorobenzotrichloride. The method gives only moderate yields, and, as previously found by Fox (*Ber.*, 1893, **26**, 653), and now confirmed by the authors, breaks down when applied to the case of *o*-chlorobenzotrichloride.

cis- and *trans*-4 : 4′-Dichlorotolane dichlorides, melting at 166—167° and 86—87° respectively, result from the action of zinc dust on the tetrachloride in alcoholic solution at 50° for two days, although under these conditions some of the *cis*-isomeride is further reduced to 4 : 4′-dichlorotolane (m. p. 175—176°), whilst at the boiling point the conversion is complete. Both the *cis*-2 : 2′- and 4 : 4′-dichlorotolane dichlorides under similar conditions give the corresponding dichlorotolanes.

251. "The effect of temperature on the equilibrium $2CO \rightleftharpoons CO_2+C$." By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

The equilibrium between carbon monoxide, carbon dioxide, and carbon has been determined for every 50° between 850° and 1100° and for 1200°.

The method adopted has been to circulate carbon dioxide continuously over purified wood charcoal heated in an electric resistance furnace of special construction until the pressure in the apparatus attained a constant value.

The values obtained for the equilibrium are as follow:

Temperature.	Carbon dioxide. Per cent. by volume.	Carbon monoxide. Per cent. by volume.
850°	6·23	93·77
900	2·22	97·78
950	1·32	98·68
1000	0·59	99·41
1050	0·37	99·63
1100	0·15	99·85
1200	0·06	99·94

From the equation

$$\frac{19,500}{T} + \log_e \frac{c_1^2}{c_2} = k$$

(derived from Le Chatelier's general equation for equilibrium in gaseous systems), the following values for k are obtained:

T.	k.
1123	20·01
1173	20·39
1223	20·24
1273	20·44
1323	20·32
1373	20·70
1473	20·65

252. "The molecular complexity in the liquid state of tervalent nitrogen compounds." By William Ernest Stephen Turner and Ernest Wyndham Merry.

The molecular complexities of nearly forty organic nitrogen compounds, comprising amines, nitrosoamines, nitriles, and amides have been determined by Ramsay and Shields' method; one, and the main, object of the investigation being to ascertain if the molecular association in the amides can be ascribed to the action of the unsaturated valencies of the nitrogen or oxygen atom present in the amido-group.

Primary amines were found to be slightly associated. Secondary and tertiary amines gave abnormally high values of the Ramsay and Shields' constant, and the results raised the question of the validity of the Ramsay and Shields' formula.

The aliphatic nitrosoamines and aliphatic nitriles are associated;

the aromatic members of these two groups of compounds are either only slightly or non-associated.

The amides and anilides examined are associated, the extent of association being of the same order as found in the aliphatic alcohols and acids. The aromatic amides, benzamide and salicylamide, are strongly associated. Below 80°, formamide is more highly associated than water, but the molecular complexity decreases rapidly with rise of temperature.

It was concluded that the cause of molecular association in the amides cannot be directly ascribed to the unsaturated character of the nitrogen or oxygen atom, and that association only occurs when these elements are found in combination in electronegative groups.

Thursday, October 20th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. H. A. Tempany and J. Haycock were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Malcolm Percival Applebey, Hill View, Foxcombe, near Oxford.

Manindranath Banerjee, 3, Padmanath Lane, Shambazar, Calcutta.

Fred Wilkinson Barwick, Rathlyn, Kilmorey Gardens, St. Margaret's-on-Thames.

Sarat Chandra Bhattacharya, M.A., Hazaribagh, Bengal, India.

André Bracher, 30, Guilford Street, W.C.

Frederick Hugh Rochfort Brady, 12, Park View Avenue, Harold's Cross, Dublin.

Stewart McGregor Bosworth, B.Sc., 65, Abingdon Villas, Kensington, W.

John C. Briggs, East View, Workington.

John Brown, B.Sc., Technical Institute, Timaru, New Zealand.

Frederick Challenger, B.Sc., 324, Mansfield Road, Carrington, Nottingham.

Reginald Thomas Colgate, 26, Birdhurst Rise, S. Croydon.

Thomas Watts Coslett, Steel Road, Northfield, Worcs.

John Hughes Davies, B.Sc., Ph.D., St. Peter's College, Peterboro'.

James Hugh Duncan, 18, Park Place, Cardiff.

William Gidley Emmett, B.A., Caius College, Cambridge.

Ainslie Jackson Ensor, B.Sc., 67, Cannon Street, Wellingborough.

John George Finlayson, B.A., 13, Monarch Terrace, Blaydon-on-Tyne.

George Alexander Godden, 18, Rylett Crescent, Shepherd's Bush.

Edmund Knecht, M.Sc., Ph.D., Municipal School of Technology, Manchester.

William Arthur Knight, M.A., 5, The Green, Marlborough.
Bertram Lambert, M.A., 34, Leckford Road, Oxford.
Kenneth Stewart Low, 3, Luxemburg Gardens, W.
Clement Ward Lowe, Thorneyholme, Knutsford.
Malcolm McNish, Shortsands, St. Neots.
James Irvine Orme Masson, M.Sc., 2, Chester Street, Edinburgh.
Riko Majima, 37, Linden Gardens, Notting Hill Gate, W.
Thomas R. Merton, B.Sc., 18, Grosvenor Street, W.
Dhirendranath Mitra, B.A., 89/2, Musjeed Bari Street, Calcutta.
Harold Moore, B.Sc., 84, Kalashnikeff Quay, St. Petersburg.
Valliyil Govindan Nair, B.A., B.Sc., 223, Upper Brook Street, C-on-M., Manchester.
John Hamilton Paterson, M.Sc., Carmyle, Wellington Street, Grimsby.
Alfred John Pennington, Oakley, Fallowfield, Manchester.
Benjamin Ashwell Posford, Wood Dene, Kippington, Sevenoaks.
Hari Prasad, B.A., B.Sc., 97, Roseneath Road, Urmston, Manchester.
Frederick Valentine Ramsden, Alexandra Street, E. St. Kilda, Victoria, N.S.W.
Thomas John Rees, B.A., B.Sc., Cwmllynfell, Swansea Valley.
Gangaram Rajendrarao Rele, 18, Entwistle Street, Manchester.
Joseph Ridgway, B.A., Rownall Hall, Wetley Rocks, Stoke-on-Trent.
James Beglar Robinson, Dairy School, Kilmarnock.
Frederick Herbert Sharpe, The Ferns, Cressington Park, Liverpool.
Percy Lancelot James Smith, M.A., Army College, Storrington, Sussex.
Jwala Prasad Srivastava, B.Sc.Tech., 20, Curzon Avenue, Victoria Park, Manchester.
Augustus George Terrey, 47, Cann Hall Road, Leytonstone, N.E.
Joseph Turner, Azo House, Birkby, Huddersfield.
Robert Lauder Mackenzie Wallis, B.A., Llwyndu, Cardiff Road, Llanishen, S. Wales.
Syed Muhammad Jusuf, B.Sc.Tech., Municipal School of Technology, Manchester.

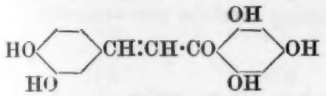
Of the following papers, those marked * were read:

***253. "The constitution of eriodictyol, of homoeriodictyol, and of hesperitin." By Frank Tutin.**

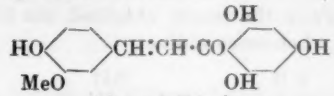
The author has methylated eriodictyol, homoeriodictyol, and hesperitin, and obtained from each of these compounds 2-hydroxy-

4 : 6-dimethoxyphenyl 3 : 4-dimethoxystyryl ketone (m. p. 154°) and 2 : 4 : 6-*trimethoxyphenyl* 3 : 4-*dimethoxystyryl ketone* (m. p. 85° when air-dried, 117·5° when anhydrous), thus proving the correctness of the conclusions of Power and Tutin (*Trans.*, 1907, **91**, 887) regarding the constitution of the three naturally-occurring substances mentioned.

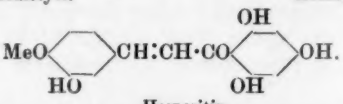
These compounds are therefore represented as follows:



Eriodictyol.



Homoeriodictyol.



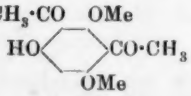
Hesperitin.

The view was expressed that naringenin is not the phloroglucinyl ester of *p*-hydroxycinnamic acid, as concluded by Will (*Ber.*, 1887, **20**, 297), but 2 : 4 : 6-*trihydroxyphenyl* 4-*hydroxystyryl ketone*.

***254. "The synthesis of 2 : 4 : 6-trimethoxyphenyl 3 : 4-dimethoxystyryl ketone, a methyl derivative of eriodictyol, homoeriodictyol, and hesperitin." By Frank Tutin and Frederic William Caton.**

Vanillin methyl ether, when condensed with 2 : 4 : 6-trimethoxyacetophenone, yields 2 : 4 : 6-*trimethoxyphenyl* 3 : 4-*dimethoxystyryl ketone* (m. p. 85° when air-dried, 117·5° when anhydrous), which is identical with the fully methylated product obtained from eriodictyol, homoeriodictyol, and hesperitin (compare preceding abstract).

The action of aluminium chloride and acetyl chloride on phloroglucinol trimethyl ether was shown to result in the formation of a *hydroxydiacetyldimethoxybenzene* (m. p. 127—128°) possessing the following constitution:

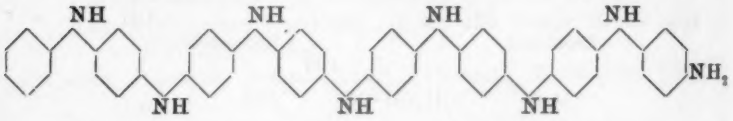


***255. "Aniline-black and allied compounds. Part I." By Arthur George Green and Arthur Edmund Woodhead.**

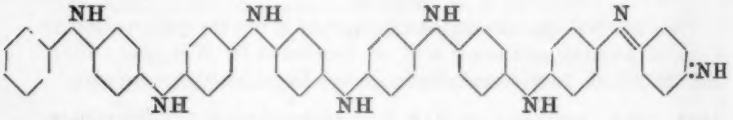
The authors, after reviewing and criticising the recent work of Willstätter and Dorogi on aniline-black, gave an account of the preparation of certain intermediate substances obtained in the conversion of aniline hydrochloride into aniline-black. The first product is emeraldine, and from it four other substances have been prepared, namely, two by oxidation, nigraniline and pernigraniline, and two by reduction, protoemeraldine and leucoemeraldine. All

these compounds form a series, any member of which can be converted into any other by the use of a suitable oxidising or reducing agent. With the view of finding their molecular weight and probable constitution, these compounds have been analysed by determining the amount of hydrogen necessary to convert the more highly oxidised substances into less highly oxidised ones, and, conversely, the amount of oxygen required to oxidise the latter. From the results obtained, the following formulæ are assigned:

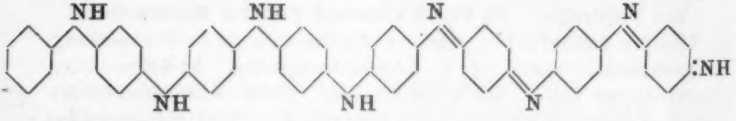
Leucoemeraldine:



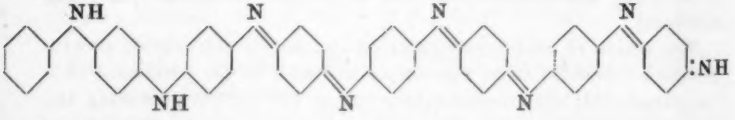
Protoemeraldine:



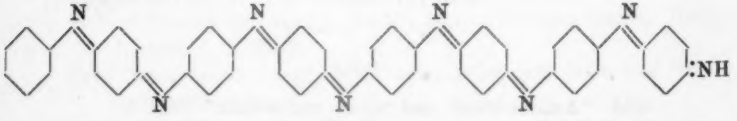
Emeraldine:



Nigraniline:



Pernigraniline:



The question as to whether the chain is open or closed is, for the present, to be regarded as unsettled.

An attempt has been made to clear up the present extremely involved nomenclature relating to aniline-black and allied substances, and, further, it has been shown that the so-called "aniline-blacks" of Kayser, Nietzki, Willstätter, etc., consist essentially of emeraldine and nigraniline mixed with higher condensation products of at present unknown constitution.

*256. **"The colour changes of methyl-orange and methyl-red in acid solution."** **By Henry Thomas Tizard.**

The author has measured quantitatively the changes in molecular colour of methyl-orange and methyl-red in solutions of varying concentrations of hydrogen ions.

From the results the following constants have been deduced:

	K_a.	K_b.
Methyl-orange (at 25°) ..... $NMe_2 \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot SO_3H$	$4 \cdot 25 \times 10^{-4}$	$< 10^{-14}$
Methyl-red (at 18°) ..... $NMe_2 \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot CO_2H$	$1 \cdot 05 \times 10^{-5}$	3×10^{-13}

The value of methyl-red as an indicator was discussed, and it was shown that its "neutral point" lies between concentrations of hydrogen ions of $10^{-5 \cdot 7}$ and 10^{-7}, which are very close to one another and to the theoretical neutral point at 10^{-7}.

*257. **"The hydrolysis of aniline salts measured colorimetrically."** **By Henry Thomas Tizard.**

The author has applied the results of the preceding paper to the colorimetric measurement of the hydrolysis of aniline hydrochloride and acetate in aqueous solution.

A determination of the depth of colour of methyl-orange in such solutions gives directly the concentration of hydrogen ion. The method compares well in accuracy with other methods for measuring hydrolysis when the base used is weaker than ammonia, as in the salts examined; at the same time measurements can be made easily and quickly.

The results of Veley and other investigators in this field were discussed.

DISCUSSION.

Mr. BARON asked whether the author had, in comparing the depth of colour, considered the effect of fluorescence in the indicator employed.

Mr. TIZARD, in reply, said that he had not observed any fluorescence in carrying out the experiments.

258. **"The structure of xanthonium and acridinium salts."** **(Preliminary note.)** **By John Theodore Hewitt and Ferdinand Bernard Thole.**

The compounds formed by xanthenol and its derivatives with mineral acids, water being eliminated, have generally been regarded as oxonium salts (Hewitt, *Zeitsch. physikal. Chem.*, 1900, **34**, 9; Decker, *Ber.*, 1901, **34**, 3300). Gomberg and Cone claim that they are carbonium compounds (*Annalen*, 1909, **370**, 142), recognising the analogy to the acridinium compounds; the latter also receive a carbonium structure from these authors.

Kehrmann (*Annalen*, 1910, **372**, 287) opposes this view, and the

present authors find that whilst phenylxanthenol and phenylmethylacridol give nearly the same absorption spectra, acids effect a change in these spectra, pointing to the salts formed in the two cases having similar constitutions. Since the view that methyl iodide forms an additive product with phenylacridine of the constitution

$$CPh\begin{cases}C_6H_4I\\C_6H_4\end{cases}>NMe$$

seems untenable, the present authors agree with Kehrmann in preferring to retain an oxonium structure for the salts obtained from xanthenol and its derivatives.

Aminc-derivatives of both series are under investigation.

259. "The application of viscometry to the measurement of the rate of reaction." (Preliminary note.) By Albert Ernest Dunstan.

With the object of introducing a method for the measurement of reaction velocities which will be applicable to cases where difficulties may be met with in the chemical determination of the concentrations of the reacting compounds, and will also be free from the necessity of using a substance foreign to the reaction as an indicator of the course of events, the author has studied the viscosity–time curves for many reactions, amongst which are: (1) moto-isomeric change; (2) isodynamic change of ethyl acetoacetate, ethyl malonate, and acetylacetone after distillation; (3) tautomeric change of dextrose and lactose in aqueous solution; (4) hydration of aldehydes; (5) formation of thiocarbamide and carbamide from ammonium thiocyanate and ammonium cyanate respectively; (6) the benzidine transformation. In those examples where the viscosity of the end product or equilibrium mixture is sufficiently different from that of the initial compound, it is possible to calculate a velocity-constant.

260. "Iodoacenaphthene."
By Holland Crompton and Muriel Kate Harrison.

Iodine acts on acenaphthene in the presence of yellow mercuric oxide. The acenaphthene is dissolved in boiling methyl alcohol, the solution is slightly cooled, and then a mixture of iodine (1 mol.) with rather more than the calculated amount of mercuric oxide is gradually added. The solution is finally raised to the boiling point and filtered. The crude iodoacenaphthene which crystallises out is first freed from mercuric iodide by dissolving it in cold chloroform, and then purified by crystallisation from methyl or ethyl alcohol. A complete purification is best effected by converting it into the picrate, crystallising this from alcohol, and then washing out the picric acid with ammonia.

Iodoacenaphthene, $C_{12}H_9I$, crystallises from alcohol in colourless needles or prisms. Fine, highly refractive, prismatic crystals are

obtained on slow evaporation of an ethyl acetate solution. It melts at 65·5°, and decomposes at a little above 180°, with copious liberation of iodine. The *picrate* crystallises in fine, orange-red needles, melting at 102·5°. It is gradually decomposed on crystallisation from alcohol. On oxidation by sodium dichromate in acetic acid solution, an iodonaphthalic acid is obtained, the anhydride of which melts at 231°. The copper salt of this acid, on heating with soda-lime, gave naphthalene and an oil which was obtained in too small an amount for identification. On fusing the acid with potassium hydroxide at 260°, 4-hydroxynaphthalic acid was obtained. From this it is probable that the acid is 4-iodonaphthalic acid derived from 4-iodoacenaphthene. It has been found, however, that whilst 4-chloro- and 4-bromo-acenaphthene form isomorphous mixtures with one another, they are not isomorphous with the iodoacenaphthene which is here described. Further experiments are therefore being undertaken to investigate the constitution of this compound.

261. "An improved form of extraction apparatus." By James McConnell Sanders.

The form of extraction apparatus illustrated in the accompanying diagram possesses several advantages over the usual form of Soxhlet extractor, or similar appliances in which the substance to be extracted is contained in a vertical tube the upper orifice of which is closed by the cork carrying the reflux condenser, the cork having to be removed each time a fresh quantity of material has to be introduced.

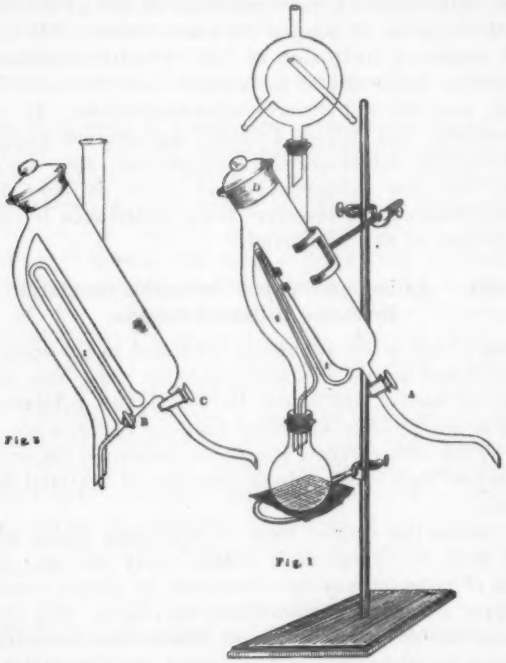
Fig. 1 shows the simpler form of apparatus, which when once mounted with its condenser is always ready for use; successive quantities of material may be introduced by simply removing the glass stopper *D*, the extraction being carried on with the tap *A* closed, when the apparatus acts as an intermittent extractor. When extraction is complete, the tap *A* is opened, and the solvent distilled off directly through the side-tube.

When using very volatile solvents, such as ether or carbon disulphide, the subsequent distillation of the solvent is facilitated by removing the cartridge containing the exhausted material, and substituting a glass boiling tube containing cold water or crushed ice.

The more elaborate form shown in Fig. 2 has two taps *B* and *C*, and when both these are kept closed the tubes *t*, *t* act as a siphon, and the extractor works intermittently. With *C* closed and *B* open, the apparatus works as a continuous extractor, or can be used also as a reflux condenser, especially if an inner tube containing cold water or ice is used.

With *B* closed and *C* open, the apparatus can be used for distilling off the solvent, as described in the case of Fig. 1.

In the author's laboratory a large model constructed of tinned copper has been in use for several months, and has proved of great value in cases where the probable amount of extractive matter was unknown, since in the event of too small a quantity of material being taken in the first instance, it was an easy matter to place



a succession of weighed cartridges in the extractor and extract with the same amount of solvent without dismounting the apparatus. This copper extractor has an internal capacity of 1000 c.c., and in order to adapt it for use with smaller quantities of material a number of "dummy" cartridges of thin sheet copper are used to fill up a certain amount of space before placing the material in position.

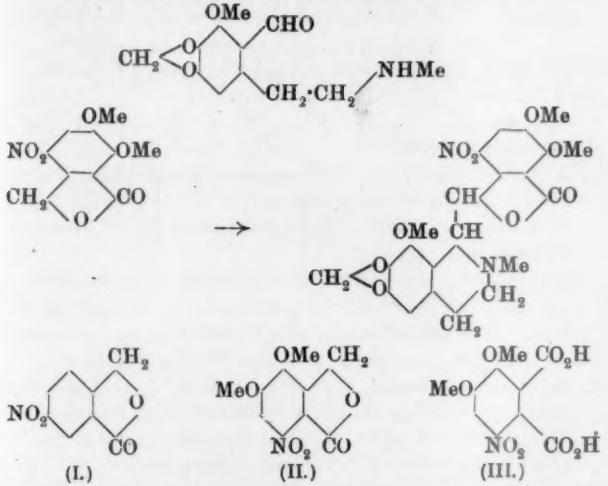
262. "The synthesis of nitrognoscopine and allied substances." (Preliminary note.) By Edward Hope and Robert Robinson.

The synthesis of gnoscopine (*r*-narcotine) has recently been accomplished (Perkin and Robinson, this vol., p. 46) by the con-

densation of cotarnine and meconine with the aid of potassium carbonate in alcoholic solution.

The present authors have observed that the condensation of cotarnine and nitrophthalides or their methoxy-derivatives occurs with very much greater facility.

Thus, nitrognoscopine is obtained in practically quantitative yields by boiling equimolecular quantities of cotarnine and nitromeconine in alcoholic solution for a few minutes. The reaction proceeds in accordance with the following scheme:



(I.) (II.) (III.)

The nitromeconine may be replaced by 5-nitrophthalide (I) or by nitro-ψ-meconine (II), the constitution of which is demonstrated by its oxidation with permanganate to the known nitrohemipinic acid (III).

It is clear therefore that the nitro-group may be in the ortho-, meta-, or para-position in relation to the reactive ·CH_2· group of the phthalide ring.

Nitrognoscopine, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3{\cdot}NO_2$, is very sparingly soluble in boiling alcohol and the usual organic solvents, but crystallises from hot trichloroethylene in bright yellow prisms, which melt and decompose to a red liquid at 191°. It is readily decomposed by warm glacial acetic acid, yielding cotarnine and nitromeconine.

The sparingly soluble, pale yellow *hydrochloride*, the *aurichloride*, and *picrate* have been prepared and analysed.

The methiodide, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3{\cdot}NO_2$,MeI, is a yellow, crystalline powder, which melts at 205—206°.

On boiling with silver chloride in aqueous solution, the *metho-*

chloride and silver iodide are obtained, and the addition of sodium hydroxide to the cooled and filtered solution gives a yellow, amorphous precipitate of the *ammonium hydroxide*. This substance dissolves in boiling water, and the solution, on cooling, deposits orange crystals of *nitronarceine*, $C_{23}H_{26}O_{10}N_2$, melting at 160—170°, and soluble both in dilute acids and alkalis.

This decomposition is entirely similar to that by which narceine is produced from narcotine or gnoscopine.

Aminognoscopine, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe)_3{\cdot}NH_2$, is formed by the reduction of nitrognoscopine with tin and hydrochloric acid in the cold. It crystallises from ethyl acetate in colourless, lustrous prisms, melting at 205°, which are not decomposed by boiling glacial acetic acid.

Acetylaminognoscopine occurs in highly characteristic bunches of needles, melting at 198°.

Nitro-ψ-gnoscopine, prepared from cotarnine and nitro-ψ-meconine, crystallises from a mixture of chloroform and alcohol in pale yellow needles, melting at 184°. In general properties it resembles the isomeric nitrognoscopine.

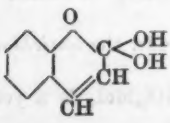
Anhydrocotarninenitrophthalide (*nitrodesdimethoxygnoscopine*), $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe){\cdot}NO_2$, crystallises in prisms melting at 176—177°. It is not so readily decomposed into its constituents by means of hot glacial acetic acid as is nitrognoscopine.

Anhydrocotarnineaminophthalide, $CH_2{:}O_2{:}C_{18}H_{11}O_2(OMe){\cdot}NH_2$, is prepared by reducing the nitro-compound with stannous chloride in glacial acetic acid solution. It crystallises from a mixture of chloroform and alcohol in rectangular plates, melting at 216—218°.

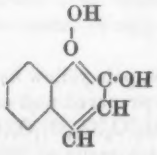
The products of these remarkable condensations are being studied in detail especially with a view to the elimination of the nitro-group and the consequent synthesis of some new alkaloids allied to narcotine and hydrastine.

263. "The constitution of coumarinic acid." By Arthur Clayton.

Two methyl ethyl ether-esters of 5-nitrocoumarinic acid have been prepared. Michael's formula (I) for coumarinic acid is therefore incorrect. The dimethyl ether-esters of 5-nitrocoumarinic acid and



(I.



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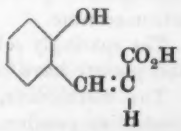


(III.)

5-nitrocoumaric acid form the same bromine additive compound. Formula II is thus excluded, and coumarinic acid is proved to be a *cis* isomeride of *o*-coumaric acid (formula III).

264. "**The reduction of chloric acid.**" **By Ralph Roscoe Enfield.**

A dilute solution of chloric acid free from the presence of other acids is not reduced by sodium amalgam. A dilute solution of chloric acid may be kept in contact with methyl alcohol for several days without any reduction taking place. The velocity of reduction of chloric acid is increased by the addition of other acids. It is suggested that this stimulating effect may be due

(1) To the mass action of the hydrogen ions in increasing the concentration of non-ionised chloric acid, on the assumption that the primary reaction is the breaking down of the non-ionised chloric acid molecule, or

(2) To the purely catalytic action of the hydrogen ions, on the assumption that the reaction is an ionic one, the reduction being that of the ClO_3 ion.

The velocity of reduction of chloric acid by methyl alcohol in presence of certain concentrations of other acids was measured. Experiments were made for nitric, sulphuric, benzenesulphonic, and oxalic acids. The stimulating effects of these acids were found to be in the order of their relative strengths. The reaction between chloric acid and ferrous sulphate was examined in the same way, and the acceleration of the reaction by various acids was determined. Acceleration constants for the various acids were calculated, and shown to be in moderate agreement with the affinity constants of the acids.

These results appear to favour the view that the reduction is that of the ClO_3 ion, accelerated by the catalytic influence of hydrogen ions.

265. "**The dynamics of the decomposition of persulphuric acid and its salts in aqueous solution.**" **By Leila Green and Orme Masson.**

The authors confirm Levi and Migliorini's work (*Gazzetta*, 1906, **36**, ii, 599) as to the simple unimolecular character of the decomposition in aqueous solution of sodium, potassium, and ammonium persulphates, and as to the large acceleration produced by added acids.

The decomposition of persulphuric acid differs from that of the sodium or potassium salt in being only apparently unimolecular, since its velocity-coefficient varies with the initial concentration, and is the sum of a true unimolecular constant (k_2) and a quantity proportional to this concentration (kA); also k_2 is nearly twice as large as the k_1 of the salts of the alkali metals.

The barium salt yields a curve with marked change of flexure,

showing large auto-acceleration, until, when the action is half completed, all the barium has been precipitated as sulphate, and a solution of pure persulphuric acid is obtained.

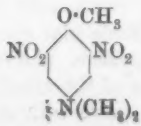
The authors suggest a theory which explains quantitatively these cases and also those of most of the mixtures studied. Each salt has its own normal unimolecular constant, which is increased by a quantity proportional to the hydrogen ions, or acid accelerator, present. The acid sulphate, which is an essential product of the action, and yet shows no catalytic effect (even although added at the outset), does not reckon in this connexion as an acid, whilst added sulphuric acid counts only as a monobasic acid. Persulphuric acid has its full dibasic value.

The addition of alkalis does not alter the simple unimolecular character of the decomposition of the sodium or potassium salt, and hardly changes the value of the constant. Barium persulphate, when mixed with barium hydroxide, shows a much larger initial rate of decomposition than the pure salt, and there is also further auto-acceleration.

Most of the work was carried out at 80°. At 90° the velocities are practically ten times as great as at 70°.

266. "Complete methylation by methyl sulphate."
By Raphael Meldola.

In the course of some experiments having for their object the preparation of compounds containing an asymmetric quinquevalent nitrogen atom combined with at least one strongly acid radicle, it became necessary to obtain, if possible, a mono-alkylated 2 : 6-dinitro-4-aminophenol (*iso*picramic acid). Some of the latter was accordingly treated with methyl sulphate and alkali in the usual way, the quantity of methyl sulphate being a little in excess of that required to introduce one methyl group. It was thought that the protective action of the nitro-groups might possibly prevent the methylation of the hydroxyl and direct the methyl group into the 4-amino-group. It was found, however, that the product was non-phenolic, and further examination showed that three methyl groups had entered the molecule, the unmethylated portion being mainly, but not entirely, unchanged *iso*picramic acid. The tendency in this case is for complete methylation to take place, the yield of trimethyl derivative being very high, in spite of the deficiency of methyl sulphate. The compound is accordingly 2 : 6-*dinitro-dimethyl*-p-*anisidine*,



0·0472 gave 7 c.c. N_2 (moist) at 13° and 761·7 mm. N = 17·56.
$C_9H_{11}O_5N_3$ requires N = 17·43 per cent.

The substance is basic, dissolving in mineral acid to a clear solution, from which orange needles separate on neutralisation with ammonia. The melting point of the pure compound is above 300°.

267. "**A study of the dissociation of the salts of hydroxylamine in aqueous solution.**" **By Ernest Barrett.**

The work is an outcome of the previously recorded influence of acids and alkalis on the rate of formation of acetoxime (Barrett and Lapworth, *Trans.*, 1908, **93**, 85). Aqueous solutions of hydroxylamine sulphate and hydrochloride, to which various fractions of a molecular equivalent of alkali had been added, were examined as to their electrolytic conductivity and degree of acidity, the latter colorimetrically, using *o*-nitrophenol as indicator. Whilst the first method gave a normal result, the latter method indicated that the gradual addition of alkali to hydroxylamine hydrochloride does not produce a steady rise in the alkalinity of the solution, but that strongly marked maxima and minima occur.

268. "**The colour and constitution of bromine solutions.**" **By Alfred Francis Joseph and James Nadoris Jinendradasa.**

On adding a soluble bromide to aqueous bromine, the colour becomes lighter. This seems probably due to the formation of a polybromide which is lighter in colour than free bromine.

The colour of bromine water was compared with that of solutions of bromine in aqueous bromides (using potassium dichromate as an intermediate standard), and it was found that after the concentration of the bromide reached normal, further addition produced little effect on the colour. This agrees with the view that in normal bromide solution the bromine is practically wholly combined.

The colorimetric results applied to the dissociation equation $k(KBr_3) = (KBr) \times (Br_2)$ give values of k varying from 0·03 to 0·07, which are similar to those obtained by Worley in the study of the strength of solutions of equal vapour pressure. Potassium and sodium bromides and hydrobromic acid gave similar results.

269. "**The reactivity of ketones towards iodine and the relative rates of tautomeric change.**" **By Harry Medforth Dawson and Robert Wheatley.**

The rate at which iodine reacts with various ketones in aqueous alcoholic solution has been measured in the presence of sulphuric acid as a catalyst. Dimethyl, methyl ethyl, methyl propyl, methyl butyl, methyl hexyl, phenyl methyl, diethyl and phenyl ethyl ketones

were examined. The mechanism of the change appears to be the same in all cases, and from the observed velocities with which the ketones react with iodine under comparable conditions, the relative rates at which the various ketones are converted from the ketonic to the enolic form have been obtained.

270. "The colour and absorption spectra of some sulphur compounds." By John Edward Purvis, Humphrey Owen Jones, and Hubert Sanderson Tasker.

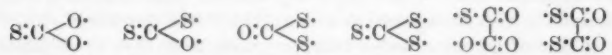
Dithio-oxalic esters have been shown to be coloured (Jones and Tasker, *Trans.*, 1909, **95**, 1904), whilst the corresponding oxalic esters are colourless; it was therefore considered of interest to examine the effect of the substitution of sulphur for oxygen in similar substances in order to obtain evidence as to the origin of the colour.

To this end twenty-two sulphur compounds of various types have been prepared and their absorption spectra examined.

The general results obtained may be summarised as follows:

(1) The displacement of oxygen by sulphur causes a marked increase in the absorptive power of the compound, and often causes the production of an absorption band and of colour.

(2) Definite absorption bands are given by sulphur compounds having the following structures, but are not exhibited by the corresponding oxygen compounds:



(I.) (II.) (III.) (IV.) (V.) (VI.)

Of these, compounds of the types I, II, IV, and VI are yellow, and V may be considered as faintly yellow in colour.

(3) The group C:S must be considered a powerful chromophore.

(4) In certain aromatic compounds, such as phenol and benzyl alcohol, the displacement of oxygen by sulphur results in the obliteration of absorption bands, which is probably due to the increase in general absorption.

(5) Oxalyl chloride, which is itself colourless, gives yellow solutions with a number of unsaturated compounds and compounds containing oxygen or sulphur.

271. "The interaction of phenyl mercaptan and thionyl chloride." By Hubert Sanderson Tasker and Humphrey Owen Jones.

As a result of an examination of the interaction of phenyl mercaptan and thionyl chloride (*Trans.*, 1909, **95**, 1911), the authors concluded that the change could be partly represented by the

equation $8C_6H_5\cdot SH + 4SOCl_2 = 8HCl + 2SO_2 + 3(C_6H_5\cdot S)_2 + (C_6H_5)_2S_4$, and suggested that sulphur dioxide was produced by the decomposition of sulphur suboxide (SO), which might be formed momentarily.

The evidence in support of this was as follows:

(1) The titre of the products of the interaction for alkali and for iodine was approximately that required by the above equation.

(2) The liquid product of the reaction had the properties and composition of diphenyl tetrasulphide.

(3) When thionyl chloride reacts with lead phenylmercaptide, $Pb(S\cdot C_6H_5)_2$, or with nickel carbonyl, sulphur dioxide is formed, and in the latter case sulphur is also produced. In both cases it would appear that sulphur dioxide has been produced by the decomposition of sulphur suboxide.

In a recent paper (*Trans.*, 1910, **97**, 1196) Smythe and Forster criticise these conclusions, and state that there is no reason to believe that the reaction is not completely represented by Holmberg's equation (*Annalen*, 1907, **359**, 81): $4RSH + SOCl_2 = R_2S_2 + R_2S_3 + H_2O + 2HCl$.

These authors have, however, entirely overlooked the evidence mentioned under (2) and (3) above, and also the fact that water was always present at the end of the reaction, and that therefore all the sulphur dioxide could not have been due to the secondary interaction between water and thionyl chloride.

272. "**Triketohydrindene hydrate.**" **By Siegfried Ruhemann.**

Triketohydrindene hydrate, $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle C(OH)_2$ (*Trans.*, 1910, **97**, 1438), yields with guanidine or benzamidine the compounds: $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle C(OH)\cdot NH(:NH)\cdot NH_2$ and

$$C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle C(OH)\cdot NH\cdot CPh:NH,$$

with hydrogen cyanide, the unstable cyanohydrin,

$$C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle C(OH)\cdot CN,$$

and with phosphorus pentachloride, 2 : 2-dichloro-1 : 3-diketohydrindene, $C_6H_4\langle\begin{matrix}CO\\CO\end{matrix}\rangle CCl_2$.

The action of potassium hydroxide on triketohydrindene hydrate proceeds in three distinct phases, which are indicated by colour changes. First, a yellow coloration is formed, which is due to the production of phenylglyoxal-*o*-carboxylic acid, $CO_2H\cdot C_6H_4\cdot CO\cdot CHO$, then the solution becomes blue, and finally colourless. The colour-

less liquid contains the potassium salt of *o*-carboxymandelic acid, $CO_2H \cdot C_6H_4 \cdot CH(OH) \cdot CO_2H$, because, with dilute sulphuric acid, it yields phthalidecarboxylic acid, $\begin{matrix} CO \cdot O \\ | \\ C_6H_4 \end{matrix} > CH \cdot CO_2H$. As regards the intermediate phase of the reaction, which is characterised by the blue colour of the alkaline solution, the author puts forward an explanation based on the analogy to the similar reaction in the case of the diketopyrrolines, when unstable blue salts are formed.

Triketohydrindene hydrate gives an intense blue coloration with α-aminoaliphatic or aliphatic aromatic acids, whereas no coloration is obtained with substituted amino-acids, for example, phenylglycine and hippuric acid, or with aromatic acids which contain the amino-group in the nucleus. So far, only two β-amino-acids have been tested, and they were found to differ, in some respects, from their isomerides, the α-amino-acids, in their behaviour towards triketohydrindene hydrate.

273. "The influence of solvents on the rotation of optically active compounds. Part XVI. The relationship between the chemical constitution and the influence of a solvent." By Thomas Stewart Patterson and Elizabeth Findlay Stevenson.

The relationship between the chemical constitution and the influence, on the rotation of ethyl tartrate, of various solvents were discussed.

274. "Solubility of calcium phosphate in saturated solutions of carbon dioxide containing ammonia." By Bernard Foster and Henry Allen Dugdale Neville.

The solubility of calcium phosphate, and of the phosphates in commercial phosphatic manures, was determined in saturated solutions of carbon dioxide containing ammonia. With increasing quantities of ammonia the quantity of phosphate passing into solution increases at first rapidly, and then more slowly, the solubility of phosphate then being almost directly proportional to the amount of ammonia present.

275. "The constitution of sodium aluminate solutions." By Roland Edgar Slade.

Hantzsch's experiments (*Zeitsch. anorg. Chem.*, 1902, **30**, 276) on the conductivity of sodium aluminate solutions have been repeated and confirmed. These experiments show that the aluminium hydroxide behaves as a monobasic acid,

The author has been unable to confirm the work of Herz (*Zeitsch. anorg. Chem.*, 1900, **25**, 155) on the existence of the compound Na_3AlO_3 in solution. The work of Russ (*Zeitsch. anorg. Chem.*, 1904, **41**, 206) and of Wood (*Trans.*, 1908, **93**, 421) on the equilibrium between crystalline aluminium hydroxide and sodium aluminate solutions was discussed. The assumptions on which Wood calculated the acidic dissociation constant of aluminium hydroxide were shown to be far from correct.

The work of Wood (*Trans.*, 1910, **97**, 878) on the acidic dissociation of the hydroxides of glucinum, zinc, and lead was similarly criticised.

ADDITIONS TO THE LIBRARY.

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Walden, *P.* Die Lösungstheorien in ihrer geschichtlichen Aufeinanderfolge. (Sammlung, Vol. XV.) Stuttgart 1910.

III. *Pamphlets.*

Blum, *L.* Ueber den Abbau von Fettsäuren im Organismus und über die gegenseitigen Beziehungen der Azetonkörper. (From the *Münchener med. Woch.*, 1910.)

Breinl, *Anton*, and **Nierenstein**, *M.* Bio-chemical and therapeutical studies on trypanosomiasis. (From the *Ann. Trop. Med. Par.*, 1909, **3**.)

Burian, *Richard*, and **Drucker**, *Karl.* Gefrierpunktsmessungen an kleinen Flüssigkeitsmengen. (From the *Zentr. Physiol.*, 1910, **23**.)

BANQUET TO PAST PRESIDENTS.

The Banquet, which was postponed from May 26th, will be held at the Savoy Hotel (Embankment Entrance) on Friday, November 11th, 1910, at 7 for 7.30 p.m., in honour of the following Past Presidents who have attained their Jubilee as Fellows of the Society:

	Elected	Served as President
Prof. William Odling, F.R.S.	1848	1873–1875.
The Rt. Hon. Sir Henry E. Roscoe, F.R.S.	1855	1880–1882.
Sir William Crookes, F.R.S.	1857	1887–1889.
Dr. Hugo Müller, F.R.S.	1859	1885–1887.
Dr. A. G. Vernon Harcourt, F.R.S. ...	1859	1895–1897.

The price of tickets will be One Guinea (£1 1*s.*) each (including wine), or Half-a-Guinea (10*s.* 6*d.*) each (not including wine).

All applications for tickets must be received not later than Friday, November 4th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on **Thursday**, November 3rd, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Researches on bleaching powder." By R. L. Taylor.

"Azomethine azo-dyes." By A. G. Green and R. N. Sen.

"Syntheses in the epinephrine series. Part II. The formation and properties of some 2:5- and 2:6-substituted pyrazines and their conversion into amino-ketones and imino-diketones." By F. Tutin.

"The absorption spectra of some substituted pyrazines and their salts." By F. Tutin and F. W. Caton.

"Studies in the camphane series. Part XXVIII. Stereoisomeric hydrazones and semicarbazones of camphorquinone." By M. O. Forster and A. Zimmerli.

"The constituents of gelsemium." By C. W. Moore.

"Some phenolic derivatives of β-phenylethylamine." By G. Barger and A. J. Ewins.

"Chloroamine reactions. Methylenechloroamine." By C. F. Cross and E. J. Bevan.

"Preparation of secondary amines from carboxylic acids. Part I. Preparation of heptadecylaniline, pentadecylaniline, and tridecylaniline." By H. R. Le Sueur.

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Issued 11/11/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 376.

Thursday November 3rd, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Charles W. Meanwell and R. O'F. Oakley were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Bertram Haward Buttle, 63, Claremont Road, Forest Gate, E.
Frank Anthony Camp, c/o Messrs. Parry & Co., Madras, India.
David Chalmers Crawford, M.A., B.Sc., Elsenburg, Mulders Vlei, Cape Colony.
Arthur Dodd, Lyndhurst, Belvedere, Kent.
Fred Holt, B.Sc., 28, Mere Street, Rochdale.
Prince Mahmood Ali Khan, B.A., Zafermanzl, Rampur State, U.P. India.
James Eckersley Myers, B.Sc., Acresfield, Gatley, Cheshire.
Sidney Herbert Newman, B.Sc., 181, Brooke Road, Upper Clapton, N.E.
Alfred Oswald Ransome, Beechwood, Greenock Road, Paisley.
Rajendra Nath Sen, M.A., M.Sc., 41, Machuabazar Street, Calcutta.
Arthur Bernard Williams, Coychurch Rectory, Bridgend, S. Wales.

Of the following papers, those marked * were read:

*276. "Researches on bleaching powder." By Robert Llewellyn Taylor.

The author has investigated the action of carbon dioxide and of air on bleaching powder.

When carbon dioxide acts on bleaching powder, either solid or in solution, nothing but chlorine is evolved. The conclusion is drawn that the action of carbonic acid is exactly like the action of any other acid, hydrochloric and hypochlorous acids being produced and decomposing each other with the liberation of chlorine. Hence the action of hydrochloric acid on carbonates is a reversible one.

Air free from carbon dioxide sweeps out very slowly a little hypochlorous acid from a solution of bleaching powder. This is due to the hydrolysis of the hypochlorite in the solution. Ordinary moist air liberates from solid bleaching powder at first a mixture of hypochlorous acid and chlorine, and finally nothing but chlorine. In aqueous solution the action is almost the same.

It was shown that the action of bromine on alkalis is a reversible one, and the conclusion is drawn that the action of chlorine is the same. The carbon dioxide in air unites with the free lime, and then the calcium chloride present reverses the action, liberating chlorine.

Air free from carbon dioxide expels a considerable amount of chlorine from a solution of bleaching powder, from which some of the free lime has been removed. Such a solution bleaches more rapidly than an ordinary solution, and calcium chloride or salt added to it helps to reverse the action, liberating more chlorine, and further stimulating the bleaching action. In the ordinary bleaching process, chlorine is probably the active bleaching agent, hypochlorous acid only playing a minor part.

Discussion.

The President asked whether the author thought it necessary to assume that carbonic acid had the power of decomposing sodium or calcium chloride, when he had shown that carbonic acid liberated chlorine from a solution of bleaching powder by combining with the free hydrate, and so reversing the action of chlorine on calcium hydrate:

$$2Ca(OH)_2 + 2Cl_2 \rightleftharpoons CaCl_2 + Ca(OCl)_2 + 2H_2O.$$

Dr. Senter, referring to the author's view that carbon dioxide liberates both hydrochloric and hypochlorous acids from bleaching powder, said that it did not seem justifiable to adduce as evidence in favour of this suggestion the fact that carbon dioxide turns methyl-

orange red in presence of sodium chloride. It could be shown (compare Bohdan von Szyszkowski, *Zeitsch. physikal. Chem.*, 1910, 73, 273) that, so far as purely chemical interchange between the components is concerned, the hydrogen-ion concentration in a solution containing carbon dioxide and sodium chloride is less than for the carbon dioxide alone in water. The observed effect on methyl-orange must therefore be ascribed to some other factor, doubtless to the so-called "neutral salt action" illustrated, for example, by the observation of Arrhenius that the catalytic action of acetic acid is increased by the addition of salts, such as sodium chloride. In the present case the neutral salt probably acts by increasing the dissociating power of the medium. The effect on methyl-orange is therefore to be ascribed to increased ionisation of the carbonic acid in the salt solution, and not to the liberation of hydrochloric acid from the sodium chloride.

Prof. GREEN could confirm Mr. Taylor's view of the reversibility of the reaction between halogens and alkalis, at least in the case of bromine and iodine. Thus an alkaline solution of iodine gave the starch reaction even in presence of a considerable excess of alkali hydroxide.

Mr. TAYLOR, in reply, stated that whilst he had shown that the carbon dioxide in the air caused the liberation of chlorine in the way described, yet the action of pure carbonic acid on bleaching powder was so very much more rapid than that of air that it suggested a complete decomposition (such as is produced by other acids) rather than the reversed action which was induced by the removal of the free lime. The equation quoted by the President did not necessarily represent what took place when bleaching powder was made, but simply the condition of equilibrium in which it existed in solution.

*277. "Azomethineazo-dyes."
By Arthur George Green and Rajendra Nath Sen.

In order to investigate the effect on the colour and dyeing properties brought about by the simultaneous presence in a compound of the azomethine and azo-groups, the authors have prepared and examined a number of dyes obtained by condensing phenetoleazobenzaldehydesulphonic acid, $OEt{\cdot}C_6H_4{\cdot}N_2{\cdot}C_6H_3(SO_3H){\cdot}CHO$, with various amines and diamines. These compounds, of various complexity, are all yellow, crystalline products, which dye wool readily in fast shades. Affinity for cotton is only manifested when the compound is derived from a para-diamine. The introduction of an auxochromic group (OH or NMe_2) has practically no effect

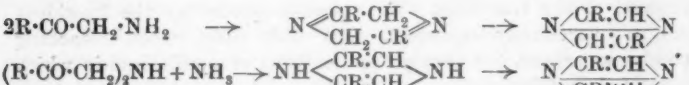
on the dyeing properties, and does not increase the tinctorial power, augment the affinity, or change the shade. Moreover, the colour is almost independent of the number of azomethine groups in the molecule. The members of the series which do not contain an auxochromic group possess, like the azo-dyes of the stilbene class, to which they have some structural analogy, a considerable degree of fastness to alkalis, light, and chlorine.

Discussion.

Prof. Green said, in reply to Dr. Cain, that the colour of the azomethineazo-dyes was uninfluenced by the introduction of naphthalene nuclei in the molecule. The ethoxy-group did not act as an auxochrome in these compounds. Ethoxy-groups apparently only exhibited auxochromic action when they could act as salt-forming groups by combination with acids.

***278. "Syntheses in the epinephrine series. Part II. The formation and properties of some 2:5- and 2:6-substituted pyrazines and their conversion into amino-ketones and imino-diketones." By Frank Tutin.**

ω-Chloroacetophenone, ω-chloro-*p*-methoxyacetophenone, and ω-*chloro*-mp-*dimethoxyacetophenone*, when heated with ammonia, yield mixtures of 2:5- and 2:6-substituted pyrazines. The two series of reactions involved proceed as follows, after replacement of the halogen:



2:5-Diphenylpyrazine, 2:6-diphenylpyrazine, pp′-*dimethoxy*-2:5-*diphenylpyrazine*, pp′-*dimethoxy*-2:6-*diphenylpyrazine*, mm′pp′-*tetramethoxy*-2:5-*diphenylpyrazine*, and mm′pp′-*tetramethoxy*-2:6-*diphenylpyrazine* have thus been prepared.

The reactions represented above can be reversed: by treatment with hydriodic acid the pyrazine derivatives mentioned yield respectively the *hydriodides* of the following bases: ω-aminoacetophenone, diphenacylamine, ω-amino-*p*-hydroxyacetophenone, pp′-*dihydroxydiphenacylamine*, ω-amino-*mp*-dihydroxyacetophenone, and mm′pp′-*tetrahydroxydiphenacylamine*.

Diphenacylamine and its derivatives, when heated with ammonia, yield 2:6-substituted pyrazines.

ω-*Chloro*-o-*methoxyacetophenone* and ω-*chloro*-op-*dimethoxyacetophenone* yield only resinous products when heated with ammonia,

but, through the agency of potassium phthalimide, salts and derivatives of *ω-amino-o-hydroxyacetophenone* and *ω-amino-op-dihydroxyacetophenone* have been prepared from these chloro-ketones.

The last-mentioned two bases, when dissolved, pass spontaneously into oo′-*dihydroxy*-2: 5-*diphenylpyrazine* and oo′pp′-*tetrahydroxy*-2: 5-*diphenylpyrazine* respectively.

All the hydroxy-ketonic bases mentioned, with the exception of ω-amino-*o*-hydroxyacetophenone, are physiologically active.

pp′-Dihydroxy-2: 5-diphenylpyrazine, on fusion, passes into a "liquid-crystalline" state, which persists over a range of 41·4°.

Numerous salts and derivatives of the compounds mentioned above were described.

***279. "The absorption spectra of some substituted pyrazines and their salts." By Frank Tutin and Frederic William Caton.**

The authors have examined the absorption spectra of 2: 6-diphenylpyrazine, *pp′*-dimethoxy-2: 6-diphenylpyrazine, and *mm′pp′*-tetramethoxy-2: 6-diphenylpyrazine, and of the monohydrochlorides and monohydrobromides of these bases. 2: 5-Diphenylpyrazine and its monohydrochloride, and *pp′*-dimethoxy-2: 5-diphenylpyrazine and the corresponding salts of this base have also been examined spectroscopically.

A number of mono- and di-acid salts of the above-mentioned bases, and of *mm′pp′*-tetramethoxy-2: 5-diphenylpyrazine were described.

***280. "Studies in the camphane series. Part XXVIII. Stereoisomeric hydrazones and semicarbazones of camphorquinone." By Martin Onslow Forster and Adolf Zimmerli.**

The α- and *β-camphorquinonehydrazones*, $C_8H_{14}<\begin{matrix}C{:}N\cdot NH_2\\ CO\end{matrix}$, produced simultaneously by the action of hydrazine hydrate on the diketone, and melting at 206° and 102° respectively, are interconvertible by heat. Phenylcarbimide transforms them into the α- and *β-camphorquinonephenylcarbamylhydrazones*, $C_8H_{14}<\begin{matrix}C{:}N\cdot NH\cdot CO\cdot NH\cdot C_6H_5\\ CO\end{matrix}$, melting at 211° and 161° respectively, a mixture of which is produced by the condensation of camphorquinone with phenylcarbamylhydrazide, and also by the action of hot aniline on the camphorquinonesemicarbazones. One of the last-named substances, the α-compound, has been

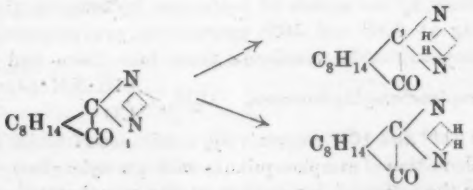
already described by Lapworth and Chapman (*Trans.*, 1901, **79**, 381), and melts at 236°, whilst the *β-camphorquinonesemicarbazone*,

melts at 147°, and is converted into the α-modification at temperatures between these melting points. Each semicarbazone is transformed into the acetyl derivative of the corresponding hydrazone by hot acetic anhydride, and of these the *α-acetylhydrazone* (m. p. 239°) is changed into the *β-acetylhydrazone* (m. p. 150°) by acetic anhydride, the converse transformation being effected by heat.

Both hydrazones are oxidised immediately to diazocamphor by cold aqueous mercury acetamide, and they are both regenerated from the diazo-compound by reduction with alcoholic ammonium sulphide. In view of these relationships, and since the members of each pair of hydrazones, semicarbazones, and phenylcarbamylhydrazones differ but little from one another in optical activity, whilst the only chemical distinction hitherto brought to light is the transformation of the β-semicarbazone into camphane-oxytriazine by alkalis, which leave the α-semicarbazone unaltered, the authors believe that stereoisomerism prevails in this group, and that their experiments give support to the Hantzsch-Werner hypothesis.

Discussion.

Mr. W. Robertson submitted that the authors had not proved their case. In the first instance, the conclusion drawn that the α- and β-compounds were not polymerides had yet to be definitely established; the wide differences in solubility and in melting point were at variance with this conclusion. Exception was also taken to the dismissal of the "phane" formula for the hydrazone on the evidence available. Moreover, if the Hantzsch-Werner tetrahedral configuration of the nitrogen atom, postulated by the authors, were examined, there were two "phane" hydrazones possible according to the linking broken on the reduction of the diazocamphor:



Thus there should be four, not two, isomeric hydrazones of

camphorquinone capable of existence on this hypothesis. Another constitution for a hydrazone was suggested as worthy of consideration, namely, $\begin{matrix}\cdot C{=\!=\!=}N\cdot\\ |\quad\quad |\\ \cdot C(OH)\cdot NH\end{matrix}$, as this "carbonyl-ammonia" derivative might be expected to react like a hydrazone of the constitution $\begin{matrix}\cdot C{:}N\cdot NH_2\\ |\\ \cdot CO\end{matrix}$.

Dr. FORSTER did not agree that two "phane" hydrazones are possible, being under the impression that according to Hantzsch and Werner the tetrahedral configuration of the nitrogen atom is supposed to apply only to those cases in which that element is multiple-linked with another atom, so that on adding hydrogen to diazocamphor the nitrogen valency-directions would distribute themselves in one plane.

***281. "The constituents of gelsemium." By Charles Watson Moore.**

The material employed in this investigation consisted of the dried rhizome and roots of *Gelsemium sempervirens*, Aiton.

An alcoholic extract of the drug, when distilled in a current of steam, yielded a small quantity of an essential oil. The non-volatile constituents of the extract consisted of a brown resin insoluble in water, and material which remained dissolved in the cold aqueous liquid. The resin, which amounted to about 3·8 per cent. of the weight of the drug, yielded pentatriacontane; traces of emodin monomethyl ether; a phytosterol, $C_{27}H_{46}O$ (m. p. 136°; $[\alpha]_D$ −40·4°); a small amount of ipuranol, $C_{23}H_{38}O_2(OH)_2$; and a mixture of palmitic, stearic, oleic, and linolic acids. The portion of the alcoholic extract of the drug which was soluble in water contained scopoletin (a monomethyl ether of æsculetin), which was present in the free state, and also in the form of a glucoside, together with a quantity of sugar. It yielded, furthermore, three alkaloidal products, one of which, gelsemine, has been obtained in a pure, crystalline state, melting considerably higher than has hitherto been recorded (178° instead of 160°), and which has been shown to possess the formula $C_{20}H_{22}O_2N_2$. The other alkaloidal products, one of which corresponds with the so-called "gelseminine" of Thompson (*Jahresber.*, 1887, 2218) and Cushny (*Ber.*, 1893, **26**, 1725), were amorphous, and no crystalline derivatives could be obtained from them.

282. "Some phenolic derivatives of β-phenylethylamine." By George Barger and Arthur James Ewins.

In order to examine the relationship between physiological activity and chemical constitution the authors have prepared a number of bases related to and intermediate between *p*-hydroxyphenylethylamine and α-3 : 4-trihydroxy-β-phenylethylmethylamine (adrenaline), the two latter bases being chemically and physiologically similar. The following bases were described: 4-*hydroxy*-β-m-*tolylethylamine*, $OH\cdot C_7H_6\cdot CH_2\cdot CH_2\cdot NH_2$, 3 : 4-*dihydroxy*-β-*phenylethylamine*, $C_6H_3(OH)_2\cdot CH_2\cdot CH_2\cdot NH_2$, 2 : 3 : 4-*trihydroxy*-β-*phenylethylamine*, $C_6H_2(OH)_3\cdot CH_2\cdot CH_2\cdot NH_2$, and ω-*amino*-2 : 3 : 4-*trihydroxyacetophenone*, $C_6H_2(OH)_3\cdot CO\cdot CH_2\cdot NH_2$.

A number of intermediate products employed in the syntheses were also described.

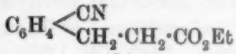
283. "Chloroamine reactions: methylenechloroamine."* By Charles Frederick Cross, Edward John Bevan, and William Bacon.

The authors have extended the observations of Raschig (*Ber.*, 1907, **40**, 4586) on monochloroamine, and have characterised the products of reaction of gelatin and various proteins with chlorine as chloroamine derivatives.

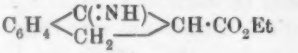
Methylenechloroamine, $CH_2{:}NCl$, is prepared by the interaction of monochloroamine and formaldehyde according to the equation $NH_2Cl + CH_2O = CH_2{:}NCl + H_2O$. The compound is readily obtained from hypochlorites (*N*/2-solution) by adding ammonium chloride and formaldehyde at the ordinary temperature. It crystallises from chloroform in large needles.

284. "The formation and reactions of imino-compounds. Part XIV. The formation of α-hydrindone and its derivatives." By Alec Duncan Mitchell and Jocelyn Field Thorpe.

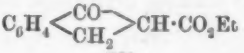
It was shown that the compound prepared by Gabriel and Hausmann by the action of ethyl sodiomalonate on *o*-cyanobenzyl chloride, and described by them as ethyl *o*-cyano-β-phenylpropionate



(I.)



(II.)



(III.)

* This name is retained pending the final settlement of the constitution of the compound, in order to indicate its relation to chloroamine.

(I), is in reality ethyl 1-iminohydrindene-2-carboxylate (II), and that it is converted by hydrochloric acid into ethyl 1-hydrindone-2-carboxylate (III).

It was also shown that under suitable conditions the normal product of this condensation, namely, ethyl cyanobenzylmalonate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(CO_2Et)_2$, can be prepared, and that on treatment with a small quantity of alcoholic sodium ethoxide it passes at once into ethyl carbonate and ethyl 1-iminohydrindene-2-carboxylate. In the same way the normal product of the condensation of ethyl sodioacetoacetate with *o*-cyanobenzyl chloride, namely, ethyl *o*-cyano-*α*-benzylacetoacetate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(COMe)\cdot CO_2Et$, passes into ethyl acetate and ethyl 1-iminohydrindene-2-carboxylate, and when the sodium compound of ethyl cyanoacetate is used, the normal product, namely, ethyl *α*-*o*-dicyano-*β*-phenylpropionate, $CN\cdot C_6H_4\cdot CH_2\cdot CH(CN)\cdot CO_2Et$, passes under the same treatment into 1-imino-2-cyanohydrindene and ethyl carbonate. The products derived from these imino-compounds and from the corresponding ketones were described.

285. "**Experiments on the synthesis of the terpenes. Part XIV. Synthesis of *d*- and *l*-Δ^5-*m*-menthenol(8), *dl*-Δ^4-*m*-menthenol(8), and their derivatives.**" **By William Henry Perkin, jun.**

The author described the conversion of 1-methyl*cyclo*hexan-3-ol-5-carboxylic acid (*Trans.*, 1909, **95**, 1889) into 1-methyl-Δ^5- and 1-methyl-Δ^4-*cyclo*hexen-3-carboxylic acids, the resolution of the former into its active modifications, and the synthesis, with the aid of these acids, of the menthenols and menthadienes mentioned in the title.

286. "**Experiments on the synthesis of the terpenes. Part XV. Δ^3-*m*-Menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene.**" **By Bernard Dunstan Wilkinson Luff and William Henry Perkin, jun.**

The authors have discovered a new method by which 1-methyl-Δ^3-*cyclo*hexen-3-carboxylic acid may be prepared in quantity and converted into Δ^3-*m*-menthenol(8) and $\Delta^{3:8(9)}$-*m*-menthadiene. The physical properties of these substances were discussed in detail.

287. "**The morphotropic relationships between silicon and carbon compounds of corresponding compositions.**" **By George Jerusalem.**

The suggestion made by Barlow and Pope as a result of their work on crystal structure, that carbon is the only element which

is fundamentally quadrivalent, and that silicon and the other elements of group IV exhibit a fundamental valency of two, finds support in the fact that no properly authenticated case is known in which carbon and silicon are isomorphously replaceable. It is remarked that corresponding carbon and silicon compounds of high molecular symmetry and great molecular complexity might be expected to exhibit isomorphous or morphotropic relationships in spite of the difference in fundamental valency between the two elements. The author has determined the crystalline forms of tribenzylcarbinol, tribenzylmethyl chloride, tribenzylsilicol, triphenylcarbinol, and triphenylsilicol, and shows that a very close morphotropic relationship holds between the first three compounds; this furnishes the first recorded case of morphotropy between corresponding carbon and silicon compounds. It was further shown that the crystallographic data, just as is the case in the humite series of minerals, accord rather better with the view that the fundamental valencies of carbon and silicon are in the ratio of 4 to 2 than with that in which the same fundamental valency of 4 is assigned to both elements.

288. "The resolution of externally compensated pavine and α-bromocamphor-π-sulphonic acid." By William Jackson Pope and Charles Stanley Gibson.

A convenient method was described for preparing the dihydropapaverine, pavine, and a process was detailed for resolving it quantitatively into its optically active components by the use of *d*- and *l*-α-bromocamphor-π-sulphonic acid. The optically active pavines can be used in effecting the resolution of externally compensated α-bromocamphor-π-sulphonic acid.

289. "The rotatory powers of the salts of *d*- and *l*-camphor-β sulphonic acid with *d*- and *l*-pavine." By William Jackson Pope and Charles Stanley Gibson.

The salts of *d*- and *l*-pavine with *d*- and *l*-camphor-β-sulphonic acid have been prepared, and determinations made of the rotatory powers of these four salts for light of three different wave-lengths. The molecular rotatory powers of the basic and acidic ions can be calculated roughly from the observed values obtained from the above salts in dilute aqueous solution, but the discrepancies are too large to be attributed to experimental error.

290. **"Externally compensated tetrahydroquinaldine (2-methyltetrahydroquinoline) and its optically active components." By William Jackson Pope and John Read.**

Externally compensated tetrahydroquinaldine (2-methyltetrahydroquinoline) crystallises when its solution in light petroleum is cooled in liquid air, and on inoculating the pure substance at the ordinary temperature with the solid thus obtained, crystallisation occurs. A method was described for quantitatively resolving the base into its optically active components by the aid of *d*- and *l*-α-bromocamphor-π-sulphonic acid.

291. **"The distillation of mixtures of enantiomorphously related substances." By William Charles Evans.**

The mode in which a number of optically active mixtures of *d*- and *l*-camphor and of *d*- and *l*-2-methyltetrahydroquinoline behave on distillation under varying conditions has been studied. It was shown that in these cases the mixtures behave like single substances on distillation, and that no separation of the components can be effected by distillation under ordinary or diminished pressures.

292. **"The tertiary acidic and alkyl derivatives of *d*-camphorimide." By William Charles Evans.**

For the purpose of investigating the similarity of behaviour of phthalimide and *d*-camphorimide, a number of acidic and alkyl derivatives of the latter have been prepared by methods applicable to the former imide. The sodio-derivative of *d*-camphorimide, the corresponding bromo- and iodo-imides, and the tertiary alkyl compounds in which the iminic hydrogen atom of *d*-camphorimide is replaced by methyl, ethyl, benzyl, and *p*-nitrobenzyl, have been prepared and examined polarimetrically.

293. **"The relation between the crystal structure and the chemical composition, constitution, and configuration of organic substances." By William Barlow and William Jackson Pope.**

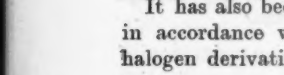
The authors have extended their previous work on this subject, and have applied the methods previously used to the study more particularly of the paraffins, olefines, and acetylenic hydrocarbons. Thus, homogeneous, close-packed assemblages have been constructed

of spheres of atomic influence of two kinds, representing carbon and hydrogen and of the volume ratio, 4 : 1, present in the numerical proportions indicated by the general composition, C_nH_{2n+2}, of the paraffins; it is found that such an assemblage can be devised to correspond in composition with any paraffin, and that the geometrical partitioning of the assemblage yields a molecular unit in close accord with the generally accepted space configuration of the paraffins. Assemblages have also been constructed corresponding with the olefine and acetylenic hydrocarbons, and these exhibit geometrical features, which, it is claimed, represent the presence in the molecule of an ethylenic and acetylenic bond respectively. The relation existing between the acetylenic and aromatic hydrocarbons has also been examined in a similar manner.

It has also been shown that the geometrical results obtained are in accordance with the crystallographic data available for the halogen derivatives of the hydrocarbons.

294. "Synthesis of 1 : 1 : 3-trimethyl*cyclo*hexene (*cyclo*geraniolene)." By Arthur William Crossley and Charles Gilling.

1 : 1 : 3-*Trimethyl*cyclo*hexan*-3-*ol* has been prepared by the action of magnesium methyl iodide on 1 : 1-dimethyl*cyclo*hexan-3-one. The hydroxyl group of the alcohol is readily displaced by bromine, and from the resulting bromide, potassium hydroxide eliminates the elements of hydrogen bromide with production of isomeric forms of 1 : 1 : 3-trimethyl*cyclo*hexene, which have been proved to be identical with *cyclo*geraniolene.



295. "The viscosity and density of cæsium nitrate solutions." By Thomas Ralph Merton.

The densities and viscosities of solutions of cæsium nitrate in water have been determined at 0°, 10°, 18°, and 25° at concentrations varying from 0·02-*N* to saturation. The results are in agreement with the general principles discovered for other salt solutions. In the case of cæsium nitrate solutions the viscosity decreases with increasing concentration.

296. "The starch-iodine reaction." By William Harrison.

The author finds that in the formation of the blue iodide of starch the presence of iodides is not necessary. The blue colour is formed with pure iodine, but the depth is increased by the presence

of any salt or weak acid. The gradual addition of alcohol changes the blue to violet, red, orange, and yellow, and the reverse change takes place on dilution with water. The same colour-change is produced by carefully heating the blue solution, and the reverse phenomena are observed on cooling.

This colour-change is analogous to the colour-change of colloidal gold solution, investigated by Zsigmondy, which changes from red to blue on adding salts.

The author succeeded in preparing a blue colloidal solution of iodine in water containing glycerol and no starch, but the colour only remained for a fraction of a second, the iodine being precipitated.

It was shown that all the iodine can be removed from starch iodide by washing with pure water, and the conclusion is drawn that the blue solution of iodine and starch is a colloidal solution of iodine, the starch acting as a protective colloid. It was further shown that the reactions of dextrins and starch celluloses can be obtained with starch under certain conditions, from which the conclusion is drawn that dextrins and starch celluloses are all different colloidal states of starch and not chemically different compounds.

297. "Aromatic hydroxy-sulphoxides."
By Maud Gazdar and Samuel Smiles.

The hydroxy-derivatives of aromatic sulphoxides are attacked by concentrated sulphuric acid, furnishing substances which exhibit a deep blue colour in that medium. As a preliminary to the investigation of the reaction, the sulphoxides of *p*-cresol, *o*- and *p*-chlorophenol and their derivatives have been examined.

298. "Binary mixtures of some liquefied gases."
By Bertram Dillon Steele and L. S. Bagster.

The authors have examined the variation of vapour pressure with temperature and with composition for mixtures of sulphur dioxide and hydrogen bromide, hydrogen sulphide and hydrogen bromide, and hydrogen sulphide and hydrogen iodide. Curves have been drawn for total and partial pressures through a considerable temperature range and also the pressure-composition curve of each pair at one temperature.

A specially constructed apparatus was employed, admitting of the removal of samples of both liquid and vapour for analysis.

The vapour-pressure curve of mixtures of sulphur dioxide and

hydrogen bromide is of a well-known type, and is such as might be expected from the properties of the ingredients. In the case of hydrogen sulphide and hydrogen bromide, the curves show that a mixture exists of minimum vapour pressure or maximum boiling point. This is interesting in view of the fact that the solution is not an electrolytic conductor, and that neither ingredient forms associated molecules, whilst the hypothesis that the peculiarity is due to the formation of an additive compound is difficult to reconcile with the fact that hydrogen sulphide and hydrogen iodide give a different form of curve. This mixture affords a new instance of the somewhat rare phenomenon of an ideal binary mixture, that is, one to which Raoult's law applies over the whole range of concentration.

299. "Lead silicates in relation to pottery manufacture." Part II.
By Sir Edward Thorpe and Charles Simmonds.

The authors have carried out some experiments showing the direction in which certain constituents of lead silicates influence the resistance of the silicates to attack by dilute acids. Alumina makes the compounds more stable; sodium oxide has the opposite effect; boron trioxide decreases the resistance in some cases, but has no such influence in others. Attention was also drawn to a recent publication by Beck, Löwe, and Stegmüller dealing with the same subject.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Armstrong, *Edward Frankland.* The simple carbohydrates and glucosides. pp. ix + 112. London 1910. (*Recd.* 17/10/10.)
From the Publishers: Messrs. Longmans, Green and Co.

Baker, *Richard T.*, and Smith, *Henry G.* A research on the pines of Australia. pp. xiv + 458. ill. Sydney 1910. (*Recd.* 25/10/10.)
From the Authors.

Leathes, *John Beresford.* The fats. pp. ix + 138. London 1910. (*Recd.* 17/10/10.)
From the Publishers: Messrs. Longmans, Green and Co.

Plimmer, *Robert Henry Aders.* Practical physiological chemistry. pp. viii + 270. ill. London 1910. (*Recd.* 17/10/10.)
From the Publishers: Messrs. Longmans, Green and Co.

Veley, *Victor Herbert*, and **Veley**, *Lilian J.* The micro-organism of faulty rum. pp. vii + 64. ill. London 1898. (*Recd.* 22/10/10.)
From the Authors.

II. *By Purchase.*

Cannizzaro, *Stanislao.* Sketch of a course of chemical philosophy. (Alembic Club Reprints, No. 18.) pp. iii + 55. Edinburgh 1910. (*Recd.* 28/10/10.)

Fourcroy, *Antoine François de.* Système des connaissances chimiques, et de leurs applications aux phénomènes de la nature et de l'art. 11 vols. Paris, Brumaire An IX. [1801]. (*Reference.*)

Groth, *Paul Heinrich.* Chemische Krystallographie. Teil III. Aliphatische und hydroaromatische. Kohlenstoffverbindungen. pp. iv + 804. ill. Leipzig 1910. (*Recd.* 28/10/10.)

Meyer, *Victor*, and **Jacobson**, *Paul.* Lehrbuch der organischen Chemie. 2nd edition. Vol. I. ii. 2. pp. 289 to 800. Leipzig 1910. (*Recd.* 28/10/10.)

Wedel, *Georg Wolffgang.* Specimen experimenti chimici novi, de sale volatili plantarum, quo demonstratur. Francofurti 1672. (*Reference.*)

III. *Pamphlets.*

Cannizzaro, *Stanislao.* La Scienza e la Scuola. (From the *Rassegna Contemporanea*, 1910, **3**.)

Dale, *H. H.*, and **Laidlaw**, *P. P.* The action of an active principle from apocynum. (From *Heart*, 1909, **1**.)

Dixon, *W. E.*, and **Halliburton**, *W. D.* The action of the choroid plexuses on the secretion of cerebro-spinal fluid. (From the *Proc. physiol. Soc.*, 1910; *J. Physiol.*, **40**.)

Dutoit, *Paul*, and **Duboux**, *Marcel.* Dosage physico-chimique des cendres du vin. (From the *J. Suisse Chim. Pharm.*, 1909, **47**.)

Emde, *Hermann.* Extraktion grosser Mengen spezifisch schwerer Flüssigkeiten mit geringen Mengen spezifisch leichter Lösungsmittel. (From the *Apoth. Zeit.*, 1909, **24**.)

Ewins, *A. J.* Some colour reactions of adrenine and allied bases. (From the *J. Physiol.*, 1910, **40**.)

Flavitzky, *F.* Application des lois d'eutéxie aux produits de fusion eutéctiques des silicates. (From the *Nat. Phil. Soc. Imp. Univ. Kazan*, 1909.)

Friend, *J. Newton.* The action of steam on iron. (From the *J. W. Scotland Iron and Steel Inst.*, 1910.)

Goris, *A.*, and **Crété**, *L.* Sur la nupharine. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

Goris, *A.*, and **Fluteaux**, *G.* Analyse d'une Scammonée naturelle. (From the *Bull. Sci. Pharm.*, 1910, **17**.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 5th, 1910.

All persons who received grants in December, 1909, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday**, November 17th, 1910, at **8.30** p.m., the following papers will be communicated:

"Preparation of secondary amines from carboxylic acids. Part I. Preparation of heptadecylaniline, pentadecylaniline, and tridecylaniline." By H. R. Le Sueur.

"The wet oxidation of metals. I. The rusting of iron." By B. Lambert and J. C. Thomson.

"The action of sodium amalgam on methylene ethers." By A. H. Salway.

"The homogeneous decomposition of ozone in the presence of oxygen and other gases." By D. L. Chapman and H. E. Jones.

"The addition of bromine to unsaturated compounds. Part II." By J. J. Sudborough and J. Thomas.

"The colour and constitution of diazonium salts. Part III. The diazo-derivatives of 2 : 7-naphthylenediamine." By G. T. Morgan and Miss F. M. G. Micklethwait.

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Issued 29/11/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 377.

THE BANQUET TO PAST PRESIDENTS.

The Banquet to the Past Presidents who have been Fellows for half a century:—

	Elected	President
Odling, William, M.A., M.B., Ph.D., F.R.S.	January 17, 1848	1873–1875
Roscoe, The Rt. Hon. Sir Henry Enfield, B.A., D.C.L., LL.D., Ph.D., M.D., D.Sc., F.R.S.	December 17, 1855.	1880–1882.
Crookes, Sir William, O.M., D.Sc., LL.D., F.R.S.	December 3, 1857	1887–1889.
Müller, Hugo, Ph.D., LL.D., D.Sc., F.R.S.	February 3, 1859	1885–1887.
Harcourt, Augustus George Vernon, M.A., D.Sc., D.C.L., LL.D., F.R.S.	February 3, 1859	1895–1897.

was held at the Savoy Hotel, on Friday, November 11th, 1910, Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President, in the Chair.

The following Fellows and guests were present:—

Acland, Dr. T. Dyke.
Ampt, Mr. G.
Angel, Mr. A.
Armstrong, Dr. E. F.
Armstrong, Prof. H. E., F.R.S.
Astbury, Mr. J., K.C.
Baggallay, Mr. F. T.
Baker, Dr. H. B., F.R.S.
Baker, Mr. J. L.
Ball, Dr. W. C.
Barger, Dr. G.
Barlow, Mr. W., F.R.S.
Bayliss, Mr. R. T.
Beale, Mr. W. P., K.C., M.P.

Bedson, Prof. P. P.
Beer, Mr. J. J.
Beilby, Dr. G. T., F.R.S., *President, Institute of Chemistry.*
Berncastle, Mr. R.
Bevan, Mr. E. J.
Black, Mr. F. W., *Director of Navy Contracts.*
Boettinger, Mr. W. von.
Bone, Prof. W. A., F.R.S.
Bonney, Rev. Canon T. G., F.R.S., *President, British Association.*
Bradford, Dr. J. R., *Secretary, Royal Society.*
Browning, Prof. K. C.
Buckley, Rt. Hon. Lord Justice.
Buckmaster, Mr. C. A.
Buckmaster, Dr. G. A.
Burgess, Mr. W. T.
Burnham, Mr. J. C.
Butlin, Mr. H. T., *President, Royal College of Surgeons.*
Bywaters, Dr. H. W.
Cain, Dr. J. C., *Editor.*
Carr, Mr. S. E., *Assistant-Secretary.*
Chapman, Mr. A. C.
Chapman, Mr. D. L.
Chattaway, Dr. F. D., F.R.S.
Church, Sir A. H., K.C.V.O., F.R.S.
Clifford, Mr. F. W., *Librarian.*
Clowes, Prof. F.
Cohen, Prof. J. B.
Colman, Dr. H. G.
Connah, Mr. J.
Cooke, Mr. H.
Cooper, Mr. Albert.
Cowap, Mr. M. D.
Cowland, Mr. J. A.
Crichton-Browne, Sir J., *Treasurer, Royal Institution.*
Cripps, Mr. R. S.
Crookes, Mr. H.
Crookes, Sir William, O.M., F.R.S.
Cross, Mr. C. F.
Crossley, Prof. A. W., F.R.S., *Honorary Secretary.*
Dewar, Sir James, F.R.S.
Divers, Dr. E., F.R.S.
Dixon, Prof. H. B., F.R.S., *The President.*
Dixon, Mr. S. W.
Dixon, Dr. W. E.
Dobbie, Prof. J. J., F.R.S.
Dorée, Dr. C.
Drage, Dr. L.
Dunstan, Prof. W. R., F.R.S.
Durrans, Mr. T. H.
Dyer, Dr. B.
Dymond, Mr. T. S.
Edgar, Mr. C. B., *Deputy Chairman of Convocation, London University.*
Egerton, Mr. A. C. G.
Eyde, Herr Generaldirektor S.
Ferguson, Prof. J.
Findlay, Dr. A.
Forsey, Sir John, *Director of Naval Stores.*
Forster, Dr. M. O., F.R.S.
Foster, Prof. G. Carey, F.R.S.
Foucar, Mr. J. L.
Fowles, Mr. G.
Frampton, Sir George, R.A.
Frankland, Dr. E. P.
Frankland, Prof. P. F., F.R.S.
Freear, Mr. H. M.
Gardner, Mr. J. A.
Garton, Sir Richard.
Geikie, Sir Archibald, F.R.S., *President, Royal Society.*
Gilling, Mr. C.
Glazebrook, Dr. R. T., F.R.S., *Director, National Physical Laboratory.*
Gould, Sir F. Carruthers.
Greenaway, Mr. A. J., *Sub-Editor.*
Griffiths, Mr. T.
Groves, Mr. C. E., F.R.S.
Gwynne, Mr. H. A.
Haas, Dr. P.
Hall, Mr. A. D., F.R.S.
Haller, Prof. A., *President de la Société Chimique de France.*
Harcourt, Mr. A. G. V., F.R.S.
Hartley, Mr. H. B.
Hartog, Mr. P. J.
Hatch, Sir Ernest, Bart, M.P.
Haworth, Mr. W. N.
Heath, Mr. J. W.
Hennings, Dr. C. R.
Hill, Mr. C. A.
Hinchley, Mr. J. W.
Hinks, Mr. E.
Hodgkinson, Prof. W. R. E.
Holloway, Mr. G. T.
Hooper, Mr. E. G.
Howard, Mr. D.
Howard, Mr. T.
Hurtley, Dr. W. H.
Ionides, Mr. A. C.
Jackson, Prof. H.
Jeyes, Mr. S. H.
Jowett, Dr. H. A. D.
Kahn, Mr. H.
Keane, Dr. C. A.
Keith, Mr. S., *Master of the Skinners' Company.*
Kemp, Mr. W. J.
Keogh, Sir Alfred, *Rector, Imperial Coll. of Science and Technology.*
Kettle, Mr. J. D.
Kinch, Prof. E.
King, Mr. A. J.
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Larmor, Sir J., F.R.S., *Secretary, Royal Society.*
Lauder, Dr. A.
Legge, Dr. T. M.
Lessing, Dr. R.
Le Sueur, Dr. H. R.
Lewkowitsch, Dr. J.
Liversidge, Dr. A., F.R.S.
Lowry, Dr. T. M.
Lupton, Mr. S.
Macara, Mr. T.
Macdonald, Mr. George.
MacEwan, Mr. P.
McGowan, Dr. G.
McKenzie, Dr. A.
Macnab, Mr. W.
Martin, Mr. N. H.
Masson, Prof. D. O., F.R.S.
Mather, Rt. Hon. Sir W.
Meldola, Prof. R., F.R.S.
Merriman, Mr. R. W.
Messel, Dr. R.
Miers, Dr. H. A., F.R.S., *Principal, London University.*
Millard, Mr. E. J.
Miller, Mr. J. B.
Mond, Sir Alfred, Bart., M.P.
Mond, Mr. R. L.
Moody, Dr. G. T.
Morgan, Dr. G. T., *Honorary Secretary.*
Morley, Dr. H. F.
Mortimer, Mr. A.
Müller, Dr. H., F.R.S.
Murphy, Mr. P.
Nagel, Mr. D. H.
Northumberland, His Grace the Duke of, *President, Royal Institution.*
Odling. Prof. W., F.R.S.
Odling, Mr. M.
Orton, Prof. K. J. P.
Pearce, Mr. W., M.P.
Pedler, Sir Alexander, C.I.E., F.R.S.
Pendlebury, Mr. W. H.
Perkin, Prof. W. H., F.R.S.
Philip, Dr. J. C.
Pickering, Mr. S., F.R.S.
Pilcher, Mr. R. B., *Registrar, Institute of Chemistry.*
Plimmer, Mr. R. H. A.
Pope, Prof. W. J., F.R.S.
Power, Dr. F. B.
Poynting, Prof. J. H., F.R.S.
Pullar, Mr. R. D.
Ramsay, Sir William, K.C.B., F.R.S.
Redwood, Sir Boverton.
Reid, Mr. W. F., *President, Society of Chemical Industry.*
Reynolds, Prof. J. E., F.R.S.
Riley-Smith, Mr. H. H., *President, Institute of Brewing.*
Roberts, Mr. A. C.
Robertson, Dr. R.
Ross, Mr. J. C.
Rowett, Mr. J. O.
Rücker, Sir Arthur, F.R.S.
Rutherford, Prof. E., F.R.S.
Sach, Mr. C. F.
Salamon, Mr. A. G.
Samuel, Rt. Hon. H. L., M.P., *Postmaster-General.*
Scott, Dr. A., F.R.S., *Honorary Treasurer.*
Seaton, Dr. E. C.
Senier, Prof. A.
Senter, Dr. G.
Shaw, Mr. W. B.
Sidgwick, Dr. N. V.
Sinnett, Mr. A. P.
Smee, Mr. J. H., *Prime Warden of the Dyers' Company.*
Smith, Mr. H. W.
Smith, Mr. R. T.
Smithells, Prof. A., F.R.S.
Spielmann, Dr. P. E.
Spiller, Mr. J.
Spiller, Mr. W.
Strathcona, Rt. Hon. Lord, F.R.S., *Chancellor, University of Aberdeen.*
Struthers, Mr. R. de J. F.
Sullivan, Mr. J. F.
Swinburne, Mr. J., *President, Faraday Society.*
Teall, Dr. J. J. H., *Director of the Geological Survey.*
Tedder, Sir Arthur J.
Teed, Dr. F. L.
Thomas, Mr. R. N. G.
Thompson, Principal S. P., F.R.S.
Thomson, Prof. J. M., F.R.S.
Thomson, Mr. W.
Thorne, Dr. L. T.
Thorpe, Sir Edward, C.B., F.R.S.
Thorpe, Dr. J. F., F.R.S.
Tilden, Sir William A., F.R.S.
Townsend, Mr. F. H.
Townshend, Col. G. R.
Tutton, Dr. A. E. H., F.R.S.
Tyrer, Mr. Thomas.
Umney, Mr. J. C.
Van Essen, Mr. E. C.
Van Essen, Mr. Jacob.
Veley, Dr. V. H., F.R.S.
Voelcker, Mr. E. W., *President, Society of Public Analysts.*
Voelcker, Dr. J. A.
Wade, Dr. J.
Walden, Mr. A. F.
Wallach, Prof. Dr. O., *Präsident der Deutschen Chemischen Gesellschaft.*
Waller, Dr. A. D., F.R.S.
Walmsley, Dr. R. M.

Warner, Mr. C. H.
Watts, Prof. W. W., *President, Geological Society.*
Wayland, Mr. W. A.
West, Dr. Samuel H.
Williams, Mr. J. Arthur.
Williams, Prof. W. Carleton.
Wolfe-Barry, Sir J., F.R.S., *Chairman, Executive Committee of the City and Guilds of London Institute.*
Worsley, Mr. P. J.
Wynne, Prof. W. P., F.R.S.

The following toasts were proposed by the PRESIDENT:—

"HIS MOST GRACIOUS MAJESTY THE KING."

"THEIR MAJESTIES THE QUEEN AND QUEEN ALEXANDRA, HIS ROYAL HIGHNESS THE PRINCE OF WALES, AND THE OTHER MEMBERS OF THE ROYAL FAMILY."

"THE PAST PRESIDENTS."

The PRESIDENT: "Although I believe in the general truth of Thackeray's dictum that public speaking after dinner ought to be done—like the carving—by a skilful person at a side-table, still there are occasions when the heart itself must speak, however unskilful the utterance, for is it not true that

> "All hearts in love use their own tongues,
> And trust no agent"?

I know I utter something of that which is in the hearts of all our Fellows to-night when I offer to you, our honoured Past Presidents, in the name of the Chemical Society, our sincere and loving congratulations on your Jubilee as Fellows; and where I fail, as fail I must, to express the thoughts that are stirring in each of us—*conamur tenues grandia!*—I trust that failure will be put down to the difficulties of the task and to the imperfections of the instrument, and not to any lack of loyalty to my teachers, and not to any want of appreciation of their achievements or of gratitude for the friendships they have given me.

On the one occasion that forms a precedent for this celebration (curiously enough, it was Friday, November 11th, 1898), the distinguished President of that day was able, with the perfervid imagination of the Scot, to classify the past presidents into two divisions—the imperial and the merely regal—and so discussed them more or less *en bloc* and impersonally. Chemists, like other men, have their peculiarities. I have heard myself and my students branded as "anhydrous chemists"; I have heard another school maintain that water is "the only begetter" of chemical action, and I am told there are even chemists who look on wine when it is red and can see in that colour nothing but the evidence of *a quinonoid structure.* But I cannot find in our past presidents any common peculiarities by which I might label them, any natural

groups into which I can divide them. At our last matriculation examination I set some question on the halogens, and received as an answer from a young lady: "Chlorine, bromine, and iodine are a very active set of chemicals, so active, indeed, that they are classed under the name of the *Hooligans*." Perhaps if our policy had been different towards those peris who have been knocking at the gate of our chemical paradise, a more imaginative president in my place would have had no difficulty in classifying or in attaching an appropriate label to the "very active set of chemicals" whose health we are toasting.

As it is, I must be personal and therefore discriminating in my praise, and you will readily understand that it is no easy matter to make discriminating and impartial remarks about, and in the presence of, one's seniors—especially when one was my university professor and examiner and another was my college tutor. I should be happy if I could reach the impartiality of the dying Irishman, who cried: "Bury me between my two wives, but—*wisht*, bhoys—push me *just a bit nearer to Biddy!*"

The Society is fortunate to contain on its roll of members twenty-four fellows of over fifty years' standing. To all of these we shall waft our greetings when we drink this toast. Of these Jubilee Fellows we have among us to-night—besides our past Presidents—Sir A. H. Church (elected 1856), George Carey Foster (elected 1856), P. J. Worsley (elected 1858), John Spiller (elected 1859), and Edward Divers (elected 1860). One name we had originally hoped to include among the Jubilee Past Presidents, that of the late W. J. Russell; but it was not to be. And another, G. D. Liveing (elected 1853) would have been among the living Presidents had his health been stronger.

I cannot read to you all (or even a selection from) the numerous friendly greetings sent by our colleagues from Europe and America. Luckily we have with us, in the President of the French Chemical Society, Professor Haller, and in the President of the German Chemical Society, Professor Wallach, representatives who can tell us with no uncertain voice what European science owes to the labours of our Jubilee Presidents.

But one short passage from a letter, headed "Washington," I will read to you:

"I am sure that I speak the feelings of all American chemists when I say that your guests more than deserve all the honour that can be shown them. Each one has made his permanent mark upon the history of chemical science, and will be remembered so long as chemistry is studied. Each one has been a source of inspiration to American chemists, and is as well known here as in his own

home—perhaps better known if perspective counts for anything. When details vanish the great realities can be seen.

With regrets for my absence, and congratulations to the Society and its guests,

Yours sincerely,

FRANK WIGGLESWORTH CLARKE.

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(1) RIGHT HON. SIR HENRY ROSCOE.

Fifty-five years ago Henry Enfield Roscoe was elected a Fellow of this Society, and read his first paper "On the Absorption of Chlorine by Water." The "sport," or, in modern terms, the "mutation," of a literary family, he will, I hope, tell us how the chemist in him was rough-hewn by Alexander Williamson, and how Bunsen shaped the ends—of his fingers. The early years of his manhood he spent with Bunsen at Heidelberg, designing and elaborating that beautiful apparatus for measuring the chemical intensity of light which has been the model for all subsequent investigators. At twenty-five, already known as a brilliant experimentalist, he was elected to the Chair of Chemistry at Manchester.

He came to Owens College in the darkest hour of her fortunes. Gifted with energy and courage, and above all with the power of seeing and drawing out what is good in others, Roscoe not only built up a great school, but he convinced his countrymen that a scientific education must be the corner-stone of our national industry. To be a successful professor in a struggling university, the professor must be—as Mrs. Ram said of Cæsar's wife—"all things to all men." I believe one of the secrets of Roscoe's success lay in his many-sidedness. The man who, in the intervals of teaching, tracked down the true vanadium, and in doing so gave order and meaning to the nitrogen group of elements, that man could turn aside from his researches to design and equip the largest laboratories of the time, could conceive and initiate a scheme which in its natural growth is within measurable distance of giving a university to every great city in the land.

Just twenty-four years ago it was my happy fortune to follow Roscoe at Owens, to breathe the atmosphere he had created, to know something of the devotion with which he was looked up to, to feel something of the stimulus which his presence radiated; and this I think I can truly say, that to his disciples the man was even more than his achievements. However much his students admire him as a researcher, however much they revere him as a teacher, it is his personality they most deeply cherish. The friend

who stood by them through evil report and good report, the heart that warmed to them, and the head that studied and understood them, *these* make up the memory of Roscoe that will be his proudest monument, and their lifelong possession.

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(2) Sir William Crookes.

Of Sir William Crookes it might be said that somewhere in that fourth state of matter he was the first to explore he found the elixir vitæ, the secret of perpetual youth. It is close on sixty years ago since Hofmann's youthful assistant described to the Chemical Society a new class of bodies—the selenocyanides. Just on fifty years ago the same youth gave us the new element thallium. Again, after some dozen years filled with a variety of experiments, he set our brains whirling with the radiometer, and started with unabated enthusiasm to explore the "chemical vacuum" and to measure the heat of "molecular shock." This led to the spectroscopy of radiant matter and of phosphorescent bodies—work of such refinement that when, twenty years later, argon and afterwards helium were discovered, it was, of course, only natural that these refractory gases should be sent to Crookes' youthful eye to have their lines read and duly mapped. Five years ago the brain that had penetrated the witchery of the opal's colouring turned its searchlight on the diamond, and the mystery of its formation was made plain to all men. For fifty years the rare earths have been his happy hunting grounds; only yesterday that elusive metal, scandium, was rounded up by Crookes, separated from the impurities of its wild companions and made to mate with numerous respectable organic wives.

On Crookes as an experimental lecturer the mantle of Faraday has fallen. No one, since the master, has come so near the marvellous in experiment; no one has awakened the imagination with more inspiring touch.

I well remember hearing him lecture on the radiometer—I think in 1874: I ought to remember it, for it enabled me next day to pass my first viva voce examination in science—very much to the surprise of my friends. The examiner had not seen the radiometer, and I managed to get him to take such an interest in its proceedings that he forgot to plough me. Again, at Sheffield in 1879, I listened to the wonderful lecture on Radiant Matter. I thought the brilliancy of experiment could go no further; but since then I have been with Sir William in South Africa and seen the men of Kimberley—men who knew something about the subject—so carried away by his lecture on diamonds that they demanded that

the lecture should be repeated, and, needless to say, this young man repeated it.

I know not what new experimental triumphs Sir William Crookes is contemplating; but this I know, he wears not only the order "For Merit," but a talisman with the motto, "Youth will be served."

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(3) Hugo Müller.

Among the many services which Hofmann rendered to English chemistry and to England, a high place must be claimed for his introduction of Hugo Müller to our former President, Warren de la Rue. Pupil of Erdmann at Leipzig, of Wöhler at Göttingen, and of Liebig at Munich, Hugo Müller came to London in 1854 to investigate the chemistry of Burmese naphtha in the laboratory of de la Rue and Co. The young chemist soon found work to his hand in that great factory which required the highest chemical skill and knowledge and the most laborious experiments to carry through; his success was marked by the adoption of many of the processes he discovered or improved. The electrotyping process and lithographic printing were by Müller's labours brought into practical use; for years everyone who fingered a banknote or stuck a postage stamp on a letter came unconsciously into personal contact with Hugo Müller's work. Engrossed as he was in these technical investigations, he yet found time to prosecute what is called pure chemistry—as ours and many other *Journals* bear witness. He was no specialist. He was equally expert in mineral analysis, crystallography, organic synthesis, and the nature of the electric discharge. And his interest in chemistry is as keen to-day as it ever was. I believe he cannot help it—his curiosity is insatiable.

It used to be said that no new discovery in chemistry was accepted on the word of the discoverer; that the experiment was sure to be repeated in some other laboratory, and either confirmed or disproved. I did not believe this until I knew Hugo Müller—now I do.

Men have been raising in London a temple to Science and Technology. If they should seek to enshrine in it a tutelary deity, they need not erect a double-headed Janus to look this way and that, but they might well model a statue from a living man who, looking straight before him, sees science and technology as one and indivisible: that man is our Past President, Hugo Müller.

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(4) A. G. Vernon Harcourt.

To Augustus George Vernon Harcourt my lifelong gratitude is due; for the fact that I am addressing you to-night from this honourable chair is entirely his doing. He found me an outcast from the classical fold, with no shred of scientific covering, and—rather ashamed. He took me to his laboratory and gave me a new interest in life and a career.

There was no care that Harcourt would not lavish on his pupils, no minutiæ of manipulation he would not repeat again and again to us. He noted all slovenliness with a watchful eye, and woe betide the wretch who spilt a drop of mercury! To this day I cannot pass a student's bench, where a speck of mercury lingers, without feeling in my pocket for a letter or a postcard, doubling one end of it like the bow of a boat, and scooping up the truant drop into my paper shovel. I commend the method—it is Harcourt's own; or did he learn it from Brodie or Faraday? Perhaps he will tell us to-night.

No one could be long in the old laboratory at Christ Church under Harcourt without being fascinated by those wonderful experiments of his on the velocity of the reaction between hydrogen peroxide and hydrogen iodide, which came as a revelation to the world of science. I shall never forget the first day I was privileged to assist in these experiments, and was set to watch the colourless liquid in its tall cylinder standing by the seconds-beating clock. If all went well, I was told, the blue colour would appear after an interval, I think, of two hours, fifteen minutes, and eleven seconds—and I must time its appearance to the tick of a second. As the afternoon wore on and the unexpected did not happen, I confess there were moments when I did not feel as

> "One in whom persuasion and belief
> Had ripened into faith."

But when the second came, and in the twinkling of an eye the blue colour spread through the liquid, I knew I had found the true scientific faith, and that my life was settled for me.

I have heard physicists declare that if they were transported to Mars they would be able to reconstruct there the unit of length from the wave-length of sodium light. Could not we also undertake, if this Society were dumped down on a planet, whose period of rotation and gravity differed from ours, to reconstruct the second, the minute, and the hour by the aid of hydrogen peroxide, hydrogen iodide, and of "Harcourt and Esson"?

I know many of Harcourt's old students, and I know they feel with me that, whatever advance towards truth and accuracy they

may have achieved, they owe it to the teaching and example of him whose one aim has been to seek truth and ensue it.

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(5) William Odling.

At his own desire I speak last of the *doyen* of our science, to whom all younger chemists owe a debt of gratitude, though possibly some of us may be unconscious of the magnitude of that debt. We have only to turn up the text-books of fifty years ago and compare them with a certain "Manual of Chemistry—descriptive and theoretical," and with other books inspired by the New Chemistry, to see the marvellous change in the order, the meaning, and the correlation of chemical facts wrought by the "New Chemists'" *quorum pars magna fuit*—William Odling. His work profoundly influenced the views of his contemporaries. He himself has told us that in the earlier days of the Society, when he was a Secretary, papers were few but discussions were numerous; there is ample evidence to prove—if proof were wanting—that in those discussions no one put the new arguments more directly, more clearly, or more cogently than Odling. What impressed me most when I listened to him, a few years later, was his extraordinary clearness of vision. It was this power of seeing things as they really are that made him seem a prophet. Let me give three instances that fastened themselves on my memory. He saw at once the meaning of Andrews' experiments on ozone, and predicted the formula O_3, the formula proved by the later researches of Soret and of Brodie; he saw in hydrogen—not a volatile metal—but "the vanishing point of the hydrocarbons"; he saw in benzene—not a ring of carbon atoms in a plane—but two groups, each of three carbon atoms touching one another, one group resting on the other in space, nearly as Pope and Barlow teach to-day.

One other personal instance of prophetic vision I may mention in confidence: Odling examined me for honours, and (*how* he did it I don't know, for I knew next to nothing at the time) he gave me a first-class. Did he foresee this occasion? Perhaps he saw I had faith—and faith has been defined as "the substance of things hoped for, the evidence of things not seen."

Gentlemen, I know you all rejoice with me that we still have with us Odling, our interpreter and prophet, and we will take care that he shall not be without honour even in his own country. My Lords and Gentlemen,—I give you the health of our Past Presidents, The Right Hon. Sir Henry E. Roscoe, Sir William Crookes, Dr. Hugo Müller, Mr. A. G. Vernon Harcourt, and Professor William Odling."

[In Sir Henry E. Roscoe's absence, owing to indisposition, the President read the following reply.]

THE RIGHT HON. SIR HENRY E. ROSCOE: "Old age has its compensations amidst its many drawbacks. To the man of science one of the chief of these compensations is the kindly appreciation which is paid by the younger workers to those whose most active life-work is over. Such an appreciation the Chemical Society gives us to-night, and this it is which cheers one in our latter days, for, after all, it is the approbation and regard of one's fellow-workers in science which is the great reward.

Then comes memory. The recollection of the great men whom it has been one's good fortune to have known. The friendships which during the varied course of life one has made. The examples which such men have set before one; and even if the comparison of the great things which they have accomplished in science may far outshine one's own efforts, yet to have worked for the same end and to have won only a small prize is something to be grateful for.

To-night our thoughts naturally turn to the distinguished men who have been our Presidents—thirty-one in number. I have known them all with the exception of two (Aikin and Phillips). This is not the occasion nor the place to enlarge upon, or even to mention, the scientific work accomplished by our past Presidents. Indeed, any such account would be unfitting, seeing that you all are as well acquainted with that work as I am.

I may, however, be permitted to recall some few reminiscences of those with whom I have come into more intimate personal contact, and such recollections may be of interest, as to most of you many of our past Presidents are merely names with certain scientific labels attached to them.

Our first President—Thomas Graham (1841-43, 1845-47)—was my master. From his lips I first heard a connected account of our science. His lectures were clear and logical; his experimental illustrations carefully prepared and always successful. He was no orator, nor was he a striking personality, but his students recognised at once in him a master mind; his influence over them was great, and I, for one, shall always feel gratitude to him as my first great teacher.

Next to Graham, and perhaps before him in the influence exerted on myself, comes Williamson (1863-65, 1869-71), a man of a totally different race and character. Graham was a cool and dour Scot, and he was not a laboratory teacher. Williamson brought to London the enthusiasm of Paris and of Giessen, and was essentially a laboratory man. Every day he came down to his laboratory brimful of new ideas, and fired the young blood of his students

with the notion that to be a chemist was the grandest thing in life. We were all of us as keen as mustard. We revelled in atomic motion; we thought no end of the four typical forms HCl, H_2O, H_3N, H_4C, and we were enamoured of the compound ethers, and even now, after fifty years, I could select by smell a sample of the seven carbon ethers from amongst a hundred other volatile compounds.

And now you must excuse me if I refer to a personal matter. Hitherto I have abstained from allusion to such matters, because I am speaking rather as an ex-President and as a representative—at least, for the moment—of my four brethren whom you honour together with myself. I have often thought that it might have been more natural if, as a pupil and assistant of Williamson, I had gone to Paris instead of to Heidelberg. I might then have had a chance of continuing the line of research which Williamson inaugurated, and which Laurent, Gerhardt and Wurtz carried further, such, for example, as the discovery of the anhydrides—a discovery which, indeed, Williamson might have made had he not overlooked the existence of the compound which he afterwards termed chloride of ethyl, now known as acetyl chloride. The name and fame of Bunsen were, however, too powerful an attraction to be resisted, and in Heidelberg I found myself in an entirely different atmosphere. Bunsen was not, like Williamson, a "theoretiker"; "one chemical fact is worth a host of theories," he used to say. So I became a follower of the great Heidelberg teacher, but only up to a certain point, for Williamson's influence made me an active disciple of what we then termed the new chemistry, in which Bunsen was not a leader.

Enthusiasm such as Williamson possessed is exhibited in many forms, and in every walk of life makes for success. No great teacher, no great worker in science, creates a school or does epoch-making work without this celestial fire. Williamson possessed it. He did not trouble himself much in grounding us in exact experimentation; I learned that afterwards from Bunsen. But he did more. He set us the example of what it is to be a "Forscher"—of a man in hot pursuit of the unknown. If he did not always gain his goal, his successes were great, and his consequent influence has been signal and lasting, not only on those who were fortunate enough to benefit from his example and to enjoy his friendship, but on the chemical world at large.

Perhaps of wider and more public renown was Hofmann (1861-63). He raised the tone of English opinion as to the position which chemistry must hold in the body politic. He gained a respect for chemical research amongst the higher classes of society in this

country which had hitherto been but slightly acknowledged. And he was a born expositor in a language foreign to his own. I shall never forget a lecture delivered by him in the old lecture theatre in Faraday's laboratory down in the cellars of the Royal Institution on the early wonders of the coal-tar colour industry. It was, indeed, an incalculable loss to British chemistry when he was called back to the fatherland.

Then there comes before my mind's eye the face and figure of my dear friend Brodie (1859-61), a devoted worker in our science—a man whose heart was set upon promoting the cause of science at Oxford, and open to all progressive ideas, both scientific and educational.

Frankland (1871-73) was my predecessor at Owens. He is another of the *Dei majores* of our Presidents, for he, like Williamson —and, may I add, like Odling?—laid a foundation stone of Modern Chemistry.

Then follow the names—the respected, well-known names—of De la Rue (1867-68, 1879-80); Abel (1875-77); Gladstone (1877-79); Gilbert (1882-83); and last, but not least, Perkin (1883-85) and Russell (1889-91). These good friends are happy memories to all of us. They "their tasks have done, home have gone and ta'en their wages." All were remarkable in their several directions—all distinguished by their love of the science and by their devotion to the welfare of the Society.

Of our living ex-Presidents, and of our distinguished Chairman, I will not speak, except to say that they hold (and in this I am vain enough to place myself) in the esteem and regard of the Fellows a position equal to that which we all assign to the memory of those who have gone before. If Britain has held and continues to hold a high position in the science of chemistry—and who shall say, in looking back at our history, that her claim to the first place is unfounded?—I think it equally true that the names of our Presidents are those of good men and true who have worthily sustained the high position of representatives of British chemistry, and of whom the Society may well be proud.

As for the Society itself I have watched, from near and far—farther now than nearer, I am sorry to think— its rise and development for more than half a century, and you will agree with me when I say that at no former period has it shown more life and done more to advance our science than it is doing at the present moment.

For myself, I thank you all from the bottom of my heart for the honour you have done me. This will remain a red-letter day with me to the end of my life."

SIR WILLIAM CROOKES: "A retrospect—a long retrospect—ought to make me melancholy. But to-night, as I stand before you, I feel elated, not depressed. 'What more felicitie can fall to creature' than to realise the wild dreams of Youth. It has been accorded to me, for more than two generations, to devote myself amid happy surroundings to the magic work of original research in chemistry and the allied sciences. Work, I have always found, is its own exceeding great reward, and now to-night there is the added reward of your approval. But to reach one's Chemical Jubilee is not altogether a matter for joy-bells. When Bret Harte was felicitated on his fiftieth anniversary, he replied that he could understand a man shooting at his best friend from behind a hedge—but he could not understand how anyone could congratulate him on being fifty!

We can all recall Tyndall's invocation to the 'Scientific Use of the Imagination.' Tyndall was right. I may truly say that what success I have achieved in science I owe to imagination. It has helped me to track anomalies and residual phenomena, for these most frequently act as finger-posts along the high road of research, directing those who can interpret their symbols to bye-ways where lurk the mysteries. An inward prescience, a grasp of events before they occur, is indispensable to pure abstract research. But it must be used with judgment, for a preconceived idea is a dangerous travelling companion to a researcher. An eminent French chemist once warned his pupils that in scientific research, unless they were careful indeed, they would generally find what they looked for!

But not only are anomalies finger-posts—they sometimes perform more active functions. Frequently they are responsible for what Huxley called 'The great tragedy of science'—the slaying of a beautiful hypothesis by an ugly fact. I fear the radiometer has been guilty of more than one tragedy of this kind. But the whirligig of time brings its revenges, and my friend, Sir James Dewar, by his researches on high vacua and low temperature, now threatens to kill the radiometer!

I will take a brief glance backwards. My old master and dear friend Hofmann first started me on the road of research. About the year 1850 he proposed I should commence an investigation on the "Selenocyanides," using for this purpose some selenium I had extracted from seleniferous residues he had brought from Tilkerode. The result of this research was published in 1851 in the *Quarterly Journal of the Chemical Society*.

When first I entered the Royal College of Chemistry, Liebig was in the height of his fame; his 'Chemistry in its Application to Agriculture' would be a useful text-book to-day. In this book

was first declared the importance—nay, the absolute necessity—of mineral matter and nitrogen to the well-being of the vegetal organism. Long and fierce were the controversies aroused by Liebig's views of the absorption of nitrogen from the air. Partisanship was keen; as a pupil of Hofmann, I naturally studied the subject in connexion with our food supply, and my interest continues to this day.

Our food depends on agriculture, and as the available wheat lands of the world inevitably contract, the economical cultivation of the soil becomes more and more a question of chemistry. At the Bristol meeting of the British Association in 1898, I reopened the nitrogen question, not with a view to produce what has been called a 'cosmic scare,' but to show how by the application of known physical and chemical reactions, the shortage of fixed nitrogen, and consequently of wheat, can be overcome.

One of the first analyses I performed at the College of Chemistry was that of the mineral cerite. The rare earths—my first, but not my only love—were then represented by ceria, lanthana, didymia, yttria, erbia, and terbia, and a specimen of yttria extracted from this cerite first gave me a key, thirty-three years later, to the citron band which then was haunting my laboratory.

Soon after Schrötter's discovery of amorphous phosphorus, the great professor came to the College of Chemistry to demonstrate to Hofmann the conversion of yellow phosphorus into the red variety. At that time I had acquired some skill in blowpipe manipulation, and was asked to help fit up the apparatus under Schrötter's directions.

The new art of photography early attracted my attention. I remember the excitement caused by the announcement of Daguerre's and Fox and Talbot's discoveries. I was working at photography in 1848, and not long after I had the privilege of being shown the Talbotype process by the master himself. One of my most highly prized relics is a copy of Talbot's 'Pencil of Nature.' In these snap-shot days it may be of interest to remember that portraiture was an affair of minutes, not seconds. I think there is one at least of my audience whom I victimised by a five-minute sitting in sunlight with his face chalked!

Niépce de St. Victor had discovered that uranium salts possessed the property of storing up light and giving it out in the dark, and in 1858 I took what was perhaps the first radium photograph in this country, by writing with solution of uranium nitrate on a card, insolating it, and then putting it face to face in the dark with a sheet of photographic paper; the image of the writing was reproduced on the paper. Also among my earliest recollections in

photography is a photograph of the solar spectrum in its true natural colours by Edmund Becquerel. Those who had the advantage of examining Becquerel's coloured photographs in their early perfection will agree with me that they hardly fell short of the recent productions of Lippmann.

I took some of the earliest stereoscopic photographs for Wheatstone, and in 1852 I commenced work on the photography of solar and metallic spectra—work which has increasingly fascinated me to the present day.

I cannot say I was at the birth of the Daltonian atom; but it is not unlikely I shall see its deposition from the supreme place in chemical theory. The chemical elements long have been considered to be manufactured articles, to use a phrase of Sir John Herschel's, and as such they are subject to change and decay. They come into being and owe their stability to the outcome of a struggle for existence—a Darwinian development by chemical evolution. Just as in the biological world we have the survival of the fittest, so in the inorganic world we have the survival of the most stable or inert.

Hunting over some residues left after the preparation of selenium, I was confronted with my first anomaly—a bright green line in the spectrum. This started me on the thallium quest, and when determining the atomic weight of thallium I came to my second anomaly—the behaviour of bodies in a vacuum balance. Following this clue, I entered on the long research which culminated in the radiometer. In the high vacua obtained in these researches many electrical eccentricities were encountered, and in the long struggle to arrive at an explanation, behold the phenomena of Radiant Matter! The action of radiant matter, or, as we now say, of electrons, on the rare earths caused some of them to glow with a phosphorescent light; on submitting this light to the scrutiny of the spectroscope, another mystery—a bright citron-coloured line in the spectrum of the glowing solid—clamoured for explanation. Hence the yttrium and samarium investigation, and then the scandium work on which I am now sedulously engaged. Incidentally radiant matter opened the door to radioactivity, and nowadays radioactive bodies are bringing new elements to light with bewildering rapidity.

One of my closest friends in the early 'fifties was Robert Murray, an old man who in his young days had been assistant to Davy in his lectures at the Royal Institution. He was with Davy during his most eventful discoveries, and I have had descriptions of the isolation of potassium and sodium from an actual eye-witness.

I was early introduced to the Royal Institution by the Secretary,

the Rev. John Barlow, my pupil at the Royal College of Chemistry. More than half a century of the Friday evening lectures means initiation into a whole cycle of wonders and mysteries wrested 'from Nature's inner shrine.' Interference of Light, by Young; Potassium and Sodium, by Davy; Liquefaction of Gases and Electricity from the Magnet, by Faraday; Low Temperature Work, by Dewar, etc., etc. The list of scientific victories is endless.

Among the early speculations I heard propounded by Faraday were those on the nature of electricity and the ultimate constitution of matter. In the highly rarefied regions of present-day speculation, our progress is so rapid as to take away one's breath! It seems no law is more certain than the Law of Change. A bit of radium that would go into a thimble has almost suddenly shaken our belief in the conservation of substance, the stability of the chemical elements, the undulatory theory of light, and the nature of electricity; has revived the dream of the alchemists and the preservation of perpetual youth, and has cast doubts on the very existence of matter itself! For physicists are beginning to say that in all probability there is no such thing as matter; that when we have caught and tamed the elusive atom, and have split it into 700 little bits, these residual particles will turn out to be nothing more than superposed layers of positive and negative electricity!

For many years I have been connected with a War Office Committee, one of whose duties it is to investigate methods of killing the greatest number of one's fellow-creatures in the shortest possible time. Researches of this character, super-Dreadnoughts, big guns, cordite, and lyddite, are the greatest of all preservers of peace.

What our country now most urgently requires are researchers. We have any number of practical men, but *brain-craft* is the master of *hand-craft*. England needs brain-craft. We want men who cultivate chemistry for its own sake without substratum of utilitarianism. Men whose discoveries, like that of phosphorus by Brandt, of the electric oxidation of nitrogen by Priestley, of potassium and sodium by Davy, of aniline by Unverdorben, of benzene by Faraday, and of chloroform by Soubeiran, seemed at the time never likely to be of the slightest use to anybody! With every man-slaying improvement our Committee elaborated, I said to myself, 'Another ten years' peace for my country!' It is the truest economy to spend money without stint to keep all such inquiries and appliances at their highest possible efficiency, knowing that in this way only can researchers be certain of securing the needful peace, without which no serious investigations can be carried to a successful conclusion.

Modern enterprise demands that as soon as a machine ceases to

work well it is best to scrap it. After sixty years of research work, I begin to feel like a drone in a busy hive. But instead of ruthlessly consigning me to the scrap-heap, my kind friends have dined me, have said most flattering things about me, and have warmed my heart.

I must again thank you not only for the honour you have paid me to-night, but for listening to the expression of thoughts that are perhaps more of personal than general interest. My experience has been long and varied, and when I contemplate the work I have tried to do in the time that has been allotted me, I am afraid I must echo the sentiment of the wise man of old: 'When a man has done, then he beginneth; and when he leaveth off, then shall he be doubtful.'"

Dr. Hugo Müller: "My colleagues have already given expression to the reminiscences and sentiments which suggest themselves most prominently on this festive occasion, and I feel there is but little for me to add on my part.

I have been connected with this Society for over fifty years, for I was a constant attendant at the meetings from as early a date as 1854, when I was an Associate; later, in 1859, I was elected a Fellow.

It is eminently satisfactory to have been connected with so prosperous a concern, and still more so when one has had some small share in its development and administration.

Our Society, which was the first of its kind and became afterwards the prototype of many others, was then still in its infancy, and the slender volumes of the *Quarterly Journal* then published give some idea of the limited extent of its activity. Sometimes there was actually a dearth of material, and appeals were occasionally made to members to furnish some matter for communication at the meetings. However, in those days the meetings used to be taken up much more with the discussion of the papers than is the case nowadays, when chemical research has become so intensely specialised and consequently affords fewer opportunities for spontaneous discussion.

At that period the Society met at rooms in Cavendish Square connected with the premises of the Polytechnic in Regent Street.

Our Society made, however, such steady progress that by the time we were located in Burlington House it had already attained a large membership, and had grown more and more flourishing, and had become indeed of decided importance.

Probably it was mainly on this account that now some of the members became very anxious to introduce certain alterations in the character of the Society, with the object of giving the Fellowship

a more professional status, and the consequent perturbation was a very serious matter for those who were in charge of affairs, and this state of things lasted for some years.

Ultimately it found vent in the formation of the Institute of Chemistry, the Society of Chemical Analysts, and the Society of Chemical Industry.

When at the present day we contemplate the varied activities of all these offsprings of our Society, we recognise the utter impossibility of comprehending them within the scope and aim of the parent society, and you will agree with me that it is a matter of congratulation that we have successfully resisted this agitation for a change in its constitution.

We may fairly consider the contents and size of our Transactions as a measure of the flourishing condition and great importance of our Society. It is also a satisfactory feature and well worth mentioning that the cost of our publications is still fairly balanced and within our income, for it is quite conceivable that at some future period the communication of papers will become so numerous and their publication so costly that the subscription of the Fellows may no longer suffice to cover the expenses, a contingency which at present is actually causing considerable trouble to one of our sister societies.

In conclusion, I beg to offer you my hearty thanks for the great honour you have done us in providing this splendid entertainment."

Mr. A. G. Vernon Harcourt: "Probably each one of us five regards the period in which he held office as a particularly important time; nor can I claim to be free from this impression. It was while I was a Secretary of the Society that we made place for the Artists, and left our apartment at the east end of old Burlington House to move into the less secluded but ampler quarters which we now occupy. On the day on which I became President, our Faraday Medal was presented by my predecessor, Dr. Armstrong, to Lord Rayleigh for the discovery of argon, resulting from his observation of the different densities of atmospheric and chemically-prepared nitrogen. In the separation and investigation of argon, Lord Rayleigh worked with Professor Ramsay, and the award of the medal was immediately followed by the announcement by Professor Ramsay of another gaseous element, helium, which, like argon, had been mistaken for nitrogen, and which had been discovered as a constituent of the atmosphere of the sun before it had been recognised on earth and found to be a constituent of our own atmosphere. The actual measurements of the spectrum of the new element and the identification of the gas from cléveite with the helium of the sun were then communicated to the Society by one

of our Past Presidents, Sir William Crookes. Two years later, when Professor Ramsay had made a complete investigation of the mineral sources and properties of helium, I had the pleasure of presenting to him the Longstaff Medal.

Many other important communications were made to the Society during those two years, and we listened to the memoirs of three great men of science—Helmholtz, Lothar Meyer, and Pasteur. But that was more than thirteen years ago, and the thirteen years between the ages of sixty-three and seventy-six make a great difference to a man; and I must hope that our proceedings at that time are better retained in the memories of many of my audience than they are in my own.

There used to be a yearly cricket match, in which the players were Chelsea Pensioners, all old men, if not all over seventy, with the further disadvantage, which is not shared by your guests to-night, that half of them had only one arm, and the other half only one leg. It would be unjust to those who arranged the match and gave dinner to the players to put among their motives the fun of trotting the old boys out, or to doubt that they watched their efforts with kindly and uncritical eyes. Fortunately your veterans are not called upon to do anything of an active kind—not even to show manipulative skill—but only to acknowledge and thank you for the kind feeling and the wish to do them honour which have brought us here.

One cannot help putting to oneself the question: What have we done more than other Past Presidents of the Society to gain this honour? All right-minded men, who are free from severe pain or grief, enjoy life, and wish it to be prolonged. What others cherish and desire, we have achieved; nor, even at this culmination of our careers, do we ask now to be dismissed, but appear before you —to use Charles Lamb's phrase—as 'jolly candidates' for the second decade of the century.

It is said that Faraday as age advanced upon him found that his memory was failing, and that he must choose for investigation some wholly new subject, not requiring any recollection of previous work; and it is said further that to this limitation was due the discovery of diamagnetism. Ordinarily, such failure of memory has a less satisfactory result. An old man may retain his interest in the parts of science which most attracted him, but of what he reads little remains a few days later, and he gradually desists from that study of the current literature of science which to younger men is both an enjoyment and a necessary condition of useful work. I have an intimate and rather painful knowledge of one such case; but I may be generalising too hastily, for some of your old Past

Presidents are able to bring their long experience to bear upon the present, and to make shrewd and illuminating remarks upon the recent progress of chemistry. I, unfortunately, am only conscious that our science is advancing and changing with bewildering speed.

Conjectural formulæ, presumably well founded, contend with one another. I remember that the constitution of camphor was being settled when I was President, and that rival formulæ received vigorous support. In the explanation of chemical changes and of the structure of molecules, human ingenuity is more than a match for the complexity of nature. When, as must happen occasionally, a hypothesis is punctured by collision with some hard fact, it is at once neatly patched with another hypothesis. The atoms in which we believed, and the molecules which passed into solution entire or flitted about as gases, are now broken up into much smaller pieces. Chemists discovered the formation of ions, independently of an electric current, and the Physicists presented them with electrons. Elements gradually disappear, at fixed rates, in a certain number of years or even of days. Our foundations are shaken; and one may fear that fifty years hence, when some of our youngest Fellows will be Past Presidents enjoying their jubilee, the very hexagon may have lost its place of honour in chemical literature.

In this connexion I will venture to refer to a question of some public importance with which chemists have to deal, namely, the influence of the rapid growth of Chemistry, and especially of chemical views—which my good friend and master, Sir B. Brodie, called 'Ideal Chemistry'—upon the teaching of the science as a part of general education.

We shall most of us agree that after reading, writing, and arithmetic, and next in value to moral instruction, comes a knowledge of the general results of scientific inquiry and some insight into the methods by which such knowledge has been gained. What parts of chemistry should find a place in such a scheme? Two limitations may be suggested, first, to facts and generalisations which are absolutely established, and secondly, to familiar substances, the chemistry of common life. The enthusiastic chemist, who aims at keeping himself abreast of his subject, and to whom the teaching of chemistry, not only to future chemists, but as a part of general education, is rightly entrusted, must find it more and more difficult to make the necessary 'cuts.' He has to bear in mind that however valuable the latest hypotheses may be for the progress of chemistry or for the advanced student who has an examination to pass, they must not be put before those who are only studying science as a part of education and chemistry as a part of science, and who may be misled into thinking that they are

well forward in chemistry because they have gained some of the latest lights.

We older chemists are often told that the amount of chemistry which has to be learnt for examinations now, is far greater than was required in our time. I do not believe it. The average of industry and of memory, the two great factors in the storage of knowledge, does not change much in fifty or sixty years. The things taught are different. Much is added, and therefore much has to be omitted. Fifty years hence there will be the same disposition of those who are in the front to speak scornfully of what is being taught now.

This line of reflection brings us to the oppressive thought, which must not be too much indulged, of the littleness of our steps forward in science compared with the immensity of what there is to be known.

'We have not gained a real height,
Nor are we nearer to the light,
Because the scale is infinite.'

I must not end this evening on so sad a note. The same fact may be looked at quite otherwise. It is the successful, or even the unsuccessful, pursuit of truth which gives happiness to each generation of scientific men, and not the value of the truth itself—the energy, the doing, not the thing done. If a time could arrive when all was known, when there could not be a new investigation or experiment, our keenest pleasure would be at an end. We may therefore feel happy in the thought of how much is still unknown. The questioning of nature is likely to last as long as the generations of mankind.

It only remains for me, in conclusion, to thank you, gentlemen, and especially my friend our President and the members of the Council, for my share in the honour and the pleasure which you have bestowed upon your old Past Presidents."

Professor WILLIAM ODLING: "From my point of view, the most important thing I have to say is to express to you my appreciation and deep gratitude of the honour you have done me. This is the third occasion on which I have been entertained publicly at the hands of the Society. In this respect, I feel I cannot express myself in words better than those you have already heard read from the letter sent by Sir Henry Roscoe.

It is a great gratification to us seniors to feel we are not altogether forgotten. We greatly appreciate the kind feeling which still attaches to us in memory of old days. If it only depended upon myself, I think I could go on for a very long time talking of the old days, but it is a question whether it would interest some of you. On a previous occasion—twelve years ago—I was honoured in a

similar manner at an entertainment which was presided over by my successor—my almost immediate successor at the Royal Institution—Sir James Dewar, who has so worthily filled the position he now holds, and who has achieved for himself a world-wide reputation. I was at that time associated with five of my very oldest friends. At the present time I am associated with others of almost as long standing, and I will venture to express a word or two with regard to each of them, not in their abstract but in their personal relations with me. I can only express regret that their number is now four. What pleasure it would have given us to have included in our numbers Perkin and Russell. Both were distinguished as chemists —one of them as a pioneer—and both of them were estimable and lovable in character, and devoted to the interests of the Society. With regard to Roscoe, he was seven years my junior as a Fellow of the Society, and seven years my junior as a President.

He always had a very youthful appearance, and I can at this moment remember making his acquaintance in Williamson's laboratory. Williamson introduced Roscoe to me as one of his most promising pupils. In expressing my appreciation of the great personal attractiveness of Williamson, I must say that those who have only known him in later years can have no conception of the magic of his influence on those who were thrown into association with him.

My acquaintance with Crookes has been hardly so long as with Roscoe, but, at any rate, it has been equally close; more close, in fact, for a number of years. I am delighted, on an occasion such as this, to be associated with Crookes as one of our guests this evening. He is as active as ever. Forty years ago, when I was a member of the Council of the Royal Society, I had a paper sent to me, and I had to say whether it was meritorious enough to be published. It was on the atomic weight of thallium. I will not say what was the nature of my report, beyond that the paper was published. But I would venture to say that the publication of that paper marked an era in this country in the determination of atomic weights—I can almost say, in any country. Even with regard to the work of my old friend Stas, it was its equal, if not superior. I do not know how many of you will remember Stas. He was affectionate and effusive in his demonstrations. I met him at the door of the International Exhibition of 1862, and, knowing his effusiveness, I held back a little. But in a minute or so he had laid hold of me, put his arms around my neck, and kissed me on the cheek, to the consternation of a burly policeman standing near.

As a lecturer on organic chemistry, it is surprising to me to find how constantly I have to refer to the researches of Dr. Müller. We esteem him for his energy, for his contributions to science, and,

above all, for his personality and amiable character, which has endeared him to all of us. I have an additional obligation, for it was through him that I became known to and associated with Kekulé, a name always to be mentioned with honour in the study of organic chemistry.

Harcourt and I have been associated as teachers at the University, and although not always seeing a thing from the same point of view, we have in the main agreed, always feeling that there existed a pleasant relationship one to another. To Harcourt we are all indebted for his history of the formation of the University Museum, an institution which has done so much for the advancement of science at Oxford. It has done great things for the study, not only of chemistry, but of natural science generally at Oxford, and this brings me to say a word or two about the association of Oxford with the Chemical Society. Fifth in order of the series of Presidents was Dr. Daubeny, who was at that time professor, and whose memory is still dear to Oxford men and is embodied in the Daubeny laboratory. He was President of the Chemical Society, and among the twenty-seven of his successors we find four other Oxford teachers. He was followed by Brodie and myself, Harcourt, and then by our present President, who, before being translated to Manchester, was the Millard lecturer at Oxford. Out of thirty-two Presidents, Oxford has contributed five, Edinburgh two, Dublin one, and Cambridge also two, although without being very prophetic we can conceive that number must be added to before long.

I should have liked to speak about my associations with all the Presidents of the Chemical Society—at any rate, I should have liked to speak of the first four or five.

Richard Phillips was one of the Presidents with whom it was my good fortune to become intimately associated, and by and by he became the editor of the *Philosophical Magazine*. He was an able critic, a great conversationalist, and a newsmonger, and from his addiction to personal joking he was spoken of (independently of his position as editor) as "Phil. Mag." I was in 1851 appointed tutor at Guy's Hospital, where I was brought into association with the second President of the Society.

A word or two about myself as one of the guests on this occasion. I became Fellow in 1848, and was therefore practically one of the founders of the Society; I acted as Secretary, and filled the position of third President, in order of series, to my old tutor, Arthur Aikin. I was afterwards translated to St. Bartholomew's Hospital, and from there to the Royal Institution, where I met Faraday, of whom it is impossible to speak without regret and veneration. Then I went to Oxford, where I met Brodie. I am still attached to Oxford, and have had the advantage, the very

great advantage of having had, both before and since my appointment, a succession of assistants of whom any professor of chemistry might be proud. First was Körner, now of Milan, whose name is a household word among us, and others who have, one after the other, achieved the distinctions of being made Fellows of the Royal Society, namely, Dupré, Dunstan, Hartley, Veley, and Marsh, whom, I am glad to say, is still with me. I wish to express my deep indebtedness to all of these, and to my faithful assistants, Fisher and Watts, who are with me still. I am delighted to be here among my juniors to-night, and to feel myself at home."

"The Foreign Members."

Sir Edward Thorpe: "It is a saying no less true than trite that 'Science knows no geographical limitations.' She recognises no national frontiers. Science is as much the common property and heritage of mankind as is the all pervading air we breathe and which we all alike share. No nation or people has any exclusive property in science, any more than it has in the universal ether or in the forces of nature. This fact is recognised in the almost universal practice of scientific societies to welcome within their ranks workers in science of every nationality. The men of science constitute one large brotherhood; they may speak a variety of tongues; they may owe allegiance to many rulers, but they are all engaged in a common cause, and they work and strive together in honourable rivalry with a unity of aim, and that is to discover and elucidate scientific truth, and to apply the knowledge of that truth to the amelioration of our common humanity. We Britishers are proverbially a sporting people. We truly love a race of any kind: competition and the struggle for supremacy are as breath to our nostrils. It is a national characteristic and pervades every department of our national activity. But your true sportsman recognises and acclaims merit wherever he meets with it. If he wins he wears his laurels modestly; if he loses, he takes his beating manfully, and offers his congratulations to the better man. I believe we carry this characteristic into the grand international struggle in which, as men of science, we are engaged. The good will which the Chemical Society bears to its foreign colleagues is reflected in the long list of its honorary and foreign members. From the earliest days of its inception, the Society has extended the hand of good fellowship to our foreign colleagues, and we are proud that we number some of the most eminent of them among our Fellows. We believe they appreciate the spirit in which our invitation has been extended to them. We, in our turn, are grateful to them for the honour and the distinction they have conferred upon us. It is with a feeling of deep gratitude that I invite you to drink to their health, and that I ask you to allow me to associate with the toast the names of Professor Haller and Professor Wallach. These gentlemen, the one

President of the Chemical Society of France, the other President of the Chemical Society of Germany, are charged with messages of felicitation to the veterans whom we are assembled here to honour. On this account you will extend them your warmest greeting. You will recognise that each of them represents a nation which has played a long and honourable part in the science to which we are all attached, and which it is our privilege to serve."

PROFESSOR ALBIN HALLER: "L'hommage que vous rendez ce soir à vos jubilaires procède, toutes proportions gardées, du même sentiment que celui très touchant, que vous avez rendu au cours de cet été, au noble souverain qui a présidé aux destinées de l'empire avec tant de tact, tant d'autorité et tant de bonheur.

Ce sentiment est fait d'affectueuse déférence et de sincère gratitude envers les hommes qui, à des titres divers, et quelles que soient leurs conditions sociales, ont honoré l'humanité et ont jeté quelque éclat sur votre pays.

De même que la France s'est associée sincèrement et de tout son cœur à votre deuil national, de même la Société chimique de Paris a tenu à apporter aux savants vénérés, dont vous célébrez aujourd'hui la brillante carrière, un témoignage de profonde sympathie et de cordiale reconnaissance pour les services qu'ils ont rendus à la science et à leur patrie.

L'estime que vous m'avez témoignée, en me conférant le titre tant envié de Membre honoraire de votre Société, me vaut, en ce jour, la joie très douce d'assister à cette réunion et de pouvoir vous exprimer la satisfaction que j'éprouve d'être l'interprète de tous nos collègues de France envers les héros de cette fête.

La première en date, de toutes les sociétés de Chimie qui existent de par le monde, votre Société a servi de modèle à toutes celles qui sont écloses à sa suite.

Son développement est intimement lié à l'évolution de la Chimie même pendant la seconde moitié du siècle dernier, et son influence, sa prospérité, sont dues autant aux hommes marquants et dévoués qui l'ont présidée qu'aux nobles et fortes traditions qu'ils ont instaurées.

Comme vos aînés vous vous êtes toujours attachés à confier sa direction aux plus vaillants et aux plus qualifiés de vos émules.

En toute circonstance, à toute époque, vous ne manquez pas de vous inspirer de votre noble adage:

'The right man in the right place.'

Il serait téméraire de vouloir énumérer, après votre très honorable Président, M. le Professeur Dixon, tout ce que la science doit au dévouement, à l'esprit d'invention et à l'habileté expérimentale des maîtres sympathiques auxquels vous rendez hommage ce soir.

Tous, en leur temps, ont tracé plus ou moins profondément leur sillon et ont donné l'exemple d'un labeur fécond et désintéressé, tout en assurant la prospérité de votre Société.

Tous les cinq ont marqué les multiples incursions qu'ils ont faites dans le domaine de la science, par des découvertes inattendues, des observations ingénieuses et des aperçus pleins de hardiesse et d'originalité.

Sans doute, l'apport constant de clartés et de faits nouveaux a souvent pour effet de dissimuler sous le voile de l'anonymat les vérités établies par nos devanciers, tant elles paraissent simples et évidentes aux esprits superficiels. Elles n'en font pas moins partie de notre patrimoine intellectuel et le nom de leurs auteurs restant à jamais gravé dans les Annales de la Science, apparaîtra au grand jour chaque fois qu'il se trouvera un chercheur désireux de remonter à l'origine de nos connaissances et d'en faire l'inventaire.

A l'heure présente, les noms de M. le Professeur Odling, de Sir Henry Roscoe, de Sir William Crookes, du Dr. Hugo Muller, et du Dr. A. G. Vernon Harcourt éveillent en nous un sentiment de vive reconnaissance pour l'œuvre originale et savante dont ils ont doté la science et pour le bel exemple de labeur qu'ils nous ont donné.

En sa qualité de fille aînée de votre Compagnie, la Société Chimique de France m'a chargé de traduire les sentiments de haute estime et de respectueuse sympathie qu'elle éprouve envers les cinq Jubilaires en leur décernant à chacun sa médaille à l'effigie de notre grand Lavoisier.

A l'hommage qu'elle rend ainsi à leur profond savoir, s'ajoutent ses vœux les plus ardents et les plus sincères pour qu'ils contribuent pendant de longues années encore au progrès de votre Société et à la notoriété scientifique de la nation britannique."

Professor Dr. Otto Wallach: "I wish to tender my most sincere and hearty thanks for the kindly feeling which has prompted my invitation for this auspicious occasion, and also for the friendly sentiments which have been expressed towards the foreign members of this Society.

At the present time it is not easy for a German professor to leave his work in order to undertake a long journey. I should, however, have been extremely sorry to miss the opportunity of personally stating how highly I prize my honorary membership of the Chemical Society.

Much less would I, as a member of the sister German Society, desire to refrain from conveying to the Past Presidents of the Chemical Society an expression of the veneration and esteem in which they are held by German chemists.

If I may be permitted to add a few words more, I will ask to be

allowed to speak in my own language. You will probably understand my German better than my English, and I also believe that what one desires to say can better be expressed in one's mother tongue.

Wenn wir, sehr geehrte Herrn, uns zu vergegenwärtigen suchen, welche Chemiker früher in England die Entwickelung unserer Wissenschaft in besonderer Weise gefördert haben, so werden wir in Erstaunen gesetzt eine wie grosse Anzahl von Persönlichkeiten daran betheiligt war. Vor unserem geistigen Auge ziehen da ausgezeichnete Männer wie ein glänzender Triumphzug vorüber, der mit den ersten Anfänge der Chemie beginnt und sich bis zum heutigen Tage erstreckt.

An der Spitze dieses imposanten Zuges schreitet die grosse Forschergestalt *Robert Boyle's*. Ihm folgen andere Koryphäen der Wissenschaft in ununterbrochener Kette. Als in den meisten heutigen Kulturländern "Chemie" noch ein unbekannter Begriff war, entdeckte *Priestley* den Sauerstoff und lehrte zugleich als erster, wie man überhaupt mit Gasen operieren muss. Mit den Gasen, von denen man früher manche für nicht coërcibel hielt, die man jetzt nach den wundervollen Methoden von Prof. *Dewar* leicht in flüssigen Zustand zwingt. Welche unerwartete Erweiterung and Weiterentwickelung die Kenntniss der Luftarten in unseren Tagen durch die ewig denkwürdigen Untersuchungen von *Lord Rayleigh* und *Sir W. Ramsay* erfahren hat, bedarf keines Hinweises. Betrachten wir weiter die Entfaltung unseres Zuges, so sehen wir nach Priestley *Cavendish* erscheinen und vor allen ragt *Dalton* hervor, der mit der Atomtheorie die Basis für die theoretische Chemie schuf. Mit Dalton kommt *Humphry Davy*. Wenn wir heut das halbhundertjährige Fellow-Jubiläum unseres Past Presidents feiern, so dürfen wir dabei wohl der Thatsache gedenken, dass in diese Tage auch ein Centenar-Jubiläum fällt. Denn grade 100 Jahr sind es, dass—im November 1810—H. Davy vor der Royal Society jene berühmte Abhandlung verlas, in der er die elementare Natur des Chlor aussprach. Wenige Jahre vorher hatte er die Welt durch Entdeckung der Alkali-metalle in Staunen gesetzt. Aber Davy hat jener Zeit noch etwas anderes entdeckt, wofür ihm die wissenschaftlische Welt dankt: er hat das Talent *M. Faraday's* entdeckt und der Chemie zugeführt.

Die Anwendung der Faraday'schen electrolytischen Gesetze gehört heut zu unserem unentbehrlichsten chemischen Handwerkszeug. Neben diesen und vielen anderen, fand Faraday bekanntlich auch das Benzol auf, die Muttersubstanz des Anilins, aus dem der verehrungswürdige *W. H. Perkin* sen., dem wir—ebenso wie seinen Söhnen—so viele wichtige Arbeiten auf dem Gebiet der organischen Chemie verdanken, den ersten technisch brauchbaren Anilinfarbstoff herstellte.

Bei Erwähnung des Benzols gedenken wir weiter *Couper's*, der

sich mit *Kekulé* in den Ruhm theilt, die Idee der Atomverkettung concipiert zu haben. Die Nennung von Kekulé's Namen bringt uns wiederum in die Erinnerung, dass Kekulé hier in London Assistent von *Stenhouse* war. Kekulé hat, wie so viele deutsche Chemiker mit, vor und nach ihm—wie die *A. W. Hofmann*, *Schorlemmer*, *Dittmar* u. a. —in diesem gastlichsten Land der Welt auch Gastfreundschaft genossen. Den Dank den wir England dafür schulden wird man in Deutschland immer lebendig finden. Wie könnte ich in dieser kurzen Stunde sie nun aber weiter alle hier aufzählen, die Träger klangvoller Namen, die *Graham*, *Williamson*, *Frankland* u. a. die wir in dem Theil des Triumphzuges englischer Wissenschaft finden, der an vergangene Zeiten mahnt! Der Blick in die Vergangenheit erweckt sonst leicht das Gefühl der Trauer, über das, was wir nicht mehr besitzen. Aber davor sind wir heut geschützt. Denn wir haben die grosse Freude und das grosse Glück in den Männern, die zu feiern wir zusammengekommen sind, Repräsentanten einer der glänzendsten älteren Epoche der Chemie noch frisch und lebenskräftig unter uns zu wissen und ihnen den Dank dafür darbringen zu können, dass sie durch ihre Arbeit eine Saat ausgestreut haben, deren reife Frucht die junge Generation der Chemiker heut erndtet.

War es doch Prof. *William Odling*, der bedeutsamen Antheil an der Ausgestaltung der Typentheorie genommen hat. Er hat ferner schon 1857 von dem "Ersetzungswerth" von Wasserstoff und Sauerstoff gesprochen und die Werthigkeitstheorie vorbereitet.

Sir *Henry Roscoe*, dessen Arbeiten über die Isolierung und über die Eigenschaften des Vanadium's für immer ein Vorbild exacter chemischer Forschung bleiben werden, hat in seinen mit R. Bunsen gemeinsam ausgeführten photochemischen Untersuchungen die Grundlage für die heutige Photochemie mit geschaffen.

Sir *William Crookes* hat nicht nur durch Entdeckung des Thallium's die Chemie bereichert. Seinem genialen Forscherblick offenbarte sich zuerst die "strahlende Materie," deren Erscheinung in der modernen Physik eine so hervorragende Rolle spielt.

Wenn, weiter, heut die katalytischen Erscheinungen wieder ganz besonders in den Vordergrund des chemischen Interesses gerückt sind, so geziemt es sich der Thatsache zu gedenken, dass Dr. *Hugo Müller* 1862 die katalytische Wirkung des Jod's bei Halogenisierungs-Processen aufgefunden hat.

Die Verdienste Dr. *Vernon Harcourt's* um die analytische und angewandte Chemie sind in England bekannt.

Wir sehen: die hochverehrten Past Presidents sind nicht nur Leiter der Chemical Society gewesen, sondern auch Leiter auf den Pfaden der Wissenschaft. Damit haben sie Schule gemacht und daher bis zur heutigen Stunde nach beiden Richtungen hin stets würdige Nachfolger

gefunden. Die Chemical Society hat unter ihren trefflichen Praesidenten in der Chemischen Welt immer wachsende Bedeutung gewonnen und mit Bewunderung und Hochachtung blicken die auswärtigen Fachgenossen auf die von ihr ausgehenden Leistungen.

Dieser hochgeschätzten und angesehenen Gesellschaft in der sich die wissenschaftlich chemischen Kräfte Englands zusammengeschlossen haben, bringe ich, zugleich im Namen der *Deutschen Chemischen Gesellschaft*, die herzlichsten Wünsche für ihr Gedeihen und ihre glückliche Weiterentwickelung bis in eine ferne Zukunft!"

"The Guests."

Sir William A. Tilden: "The object of this gathering is to offer to our senior Past Presidents an expression of affectionate homage. On such an occasion we desire before all things the sympathy of our friends. I rise, therefore, with great pleasure, to ask you to return thanks to the large number of eminent men who have assembled with us to-night, and who, by their presence and by the words which have been expressed by some of them, have added lustre and fervour to the occasion. Among them are, not only representatives of science, but of a great variety of other interests, and this is a proof that our senior Past Presidents are known and honoured far beyond the circle which is represented by the Chemical Society. I will only venture to mention the names of a few of our guests, and the toast which I have the pleasure to propose will be coupled with three of them. We have with us a member of the Government, and we are glad to be honoured by his presence; the House of Commons is strongly represented by half a dozen eminent members. Then there are the President and the Secretaries of the Royal Society, who are never missing on any occasion when honour is to be given to the votaries of science, and we have the President and Treasurer of the famous Royal Institution, the home of chemistry from Davy to Dewar. To the Presidents of the French and German Chemical Societies we owe a very special expression of thanks, not only for their kind and sympathetic words, but for the immense trouble they have taken in making long journeys for the express purpose of attending to-night. The Presidents of a number of kindred societies which work on similar lines to the Chemical Society are also present, as well as representatives of other institutions, educational, scientific, and so forth. Among these representatives I hope you will excuse me if I refer specially to the venerable Chancellor of the University of Aberdeen. Beside these, we have a number of gentlemen representing not only science, but literature, while a very eminent sculptor sits not far from me. I give you the toast of 'The Guests,' coupled with the names of his Grace the Duke of Northumberland, who is expected to become a

member of the Council of the Royal Society, Mr. Herbert Samuel, Postmaster-General, and Herr Eyde, who represents what may be called the chemical industry of the future."

The Duke of Northumberland: "We have felt it a very great honour to be the guests of yourselves upon this occasion, and to have had the privilege of joining in honouring the distinguished Past Presidents whom you have honoured to-night. I should like to say a word or two to express my admiration of, and gratitude to, Sir William Crookes. We all know that he has gone through many arduous struggles, and we know that he has made a reputation for manipulation, for patience, and research. I venture to think no finer manipulation has been displayed by him or greater patience than that of piloting the President of the Royal Institution through his duties. I am struck by the great advances in civilisation which are depicted by the menu. I see on the outside a very fine picture, the portraits of five Past Presidents of this Society; but I observe there is a sixth who occupies a very large space in the page, and I have no doubt it is a very distinguished Past President of the Chemical Society. I can only say that if I had had to dine with him I should have brought with me hard-boiled eggs! If one looks at the menu, he will see that chemistry is devoted to a very different object from which it is supposed to be. Some gentlemen might perhaps inform us what chemical action is going on now. I thank you on behalf of the guests."

The Right Hon. Herbert Samuel, M.P.: "At this hour I shall earn your gratitude if I suppress the speech I should otherwise have delivered—incisive, eloquent, brilliant, humorous, and perhaps lengthy, as you may assume it would otherwise have been. I wish to join in expressing the gratitude of the guests for the invitation that has been tendered to us. It has been a privilege to us all to join in doing honour to men whose lives have been finely spent, men who have pursued research for its own sake. They have 'set their hearts upon the goal, not on the prize,' and have added fresh lustre upon the annals of British science."

Herr Generaldirektor S. Eyde: "So many eminent speeches have been made here to-night that were it not for the fact that I have been called upon to speak, I should never have ventured to do so.

Having, however, been afforded this opportunity, I feel it to be a great pleasure to thank you for your kindness and hospitality, and for the great honour you have done me in inviting me here to-night, and I am sure that all the other foreign guests will join me in my most cordial thanks to the Society for this honour.

It is, for me especially, a great pleasure to be present, as this

Society represents the British chemical science which primarily gave the world the idea of the important problem of fixing the nitrogen of the air.

A hundred years ago Priestley and Cavendish discovered what Lord Rayleigh, Sir William Ramsay, and, above all, Sir William Crookes successfully developed.

In Professor Birkeland's and my work on the same problem, *these* names served as beacons in the atmosphere, and guided us on our way, so that we have *British* science to thank in many respects for our success in creating an industry upon the problem of the fixation of the nitrogen of the air.

Formerly your countrymen came over to Norway to view the scenery of our large waterfalls and mountains, but to-day we send these natural properties to this country, in the form of a fertiliser, to enrich your soils.

We have sent this product to almost all parts of the world, and it is particularly interesting to note that the results have proved better in the British Isles than anywhere else, and I can only regard the fact that the Norwegian air put into British soil gives such good results, as a sign of the strong feeling of sympathy which, I am proud to say, prevails between our countries.

I wish to conclude these words with the toast of the further prosperity of this famous and distinguished Society."

Thursday, November 17th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. Harry Farrands and Percy G. Ward were formally admitted Fellows of the Society.

The PRESIDENT read the following letter:

Home Office, Whitehall,
July 6th, 1910.

SIR,—I am commanded by the King to convey to you hereby his Majesty's thanks for the loyal and dutiful address of the President, Council, and Fellows of the Chemical Society, expressing their sympathy with his Majesty on the occasion of the lamented death of his late Majesty King Edward the Seventh, and congratulation on his Majesty's accession to the throne.

I am, Sir, your obedient servant,
WINSTON S. CHURCHILL.

The Hon. Secretary,
The Chemical Society,
Burlington House, W.

The PRESIDENT stated that he had received the following letter from Professor Körner:

MILANO LI 8 *Ottobre*, 1910.

HOCHGEEHRTER HERR PRÄSIDENT:

Die Feier, welche Freunde und Collegen gelegentlich der 70ten Wiederkehr meines Geburtstages (20. April, 1839) veranstaltet haben und die erst am 15. Mai dieses Jahres zur Ausführung kommen konnte, hat eine ganz besondere Zierde empfangen durch die nur allzu schmeichelhafte Anerkennung, welche die Chemische Gesellschaft zu London in prächtig ausgestatteter Adresse meinem Wirken als Lehrer und Forscher hat zu Theil werden lassen. Ich brauche Ihnen wohl nicht zu sagen, wie sehr mich diese wohlwollende Beurtheilung erfreut hat und wie hoch ich die Ehre schätze, die ich dadurch erhalten habe.

Ich bitte die Chemische Gesellschaft, und zugleich ihren Präsidenten, Herrn Professor Harold B. Dixon, meinen wärmsten Dank für diese Ehrung entgegenzunehmen und verbleibe, Herr Präsident, mit ausgezeichneter Hochachtung.

Ihr,

sehr ergebener,

PROF. W. KÖRNER.

Herrn Professor Harold B. Dixon, F.R.S.,
Präsident der Chemischen Gesellschaft zu London.

The PRESIDENT announced that the Eighth International Congress of Applied Chemistry would be held in Washington and in New York in September, 1912.

He also announced that a letter had been received from the Board of Trade drawing the attention of Fellows of the Society to the forthcoming International Exhibition to be held in Turin next year. A Royal Commission under the chairmanship of the Earl of Lytton is now engaged in organising exhibits illustrative of British Industry and Agriculture. The formation of a Scientific Section in the Exhibition is proposed.

Certificates were read for the first time in favour of Messrs.:

Edward Anderson, Hill View House, Waun Wen Road, Swansea.
Walter Norman Burbridge, Uplands, Foxley Lane, Purley.
John Fisher Carmichael, B.Sc., Tower Building, Liverpool.
Henry George Alan Harding, Darling Street, Chatswood, Sydney, N.S.W.
William Alfred Jenkin, 6, Bella Vista, Rio Tinto, Spain.

John Watterson Miller, Lynwood, Cantilupe Street, Hereford.
Walter Roman Moore, 55, Gloucester Street, Norwich.
Frank Henry Plews, 28, Gellatly Road, St. Catherine's Park, S.E.
Henry Stanley Raper, 599, Spadina Avenue, Toronto.
George Douglas Summers, Easington Lodge, Sproughton, Ipswich.

Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3) in favour of Messrs.:

Charles Crichton, Afrikander Mine, Klerksdorp, Transvaal.
Marshall Perley Cram, A.M., Ph.D., Brunswick, Maine, U.S.A.
Count Arnaud de Gramont, Rue de l'Universite 49, Paris.
Alleyne Leechman, B.A., 55, Main Street, Georgetown, British Guiana.
John Fleming Culun Brown Vance, 947, Richard Street, Vancouver, B.C.

Of the following papers, those marked * were read:

***300. "Preparation of secondary amines from carboxylic acids Part I. Preparation of heptadecylaniline, pentadecylaniline and tridecylaniline." By Henry Rondel Le Sueur.**

Heptadecylaniline, $C_{17}H_{35}\cdot NH\cdot C_6H_5$, is readily obtained by heating α-anilinostearic acid, $C_{16}H_{33}\cdot CH(NHPh)\cdot CO_2H$, to considerably above its melting point, whereby it loses carbon dioxide:

$$C_{16}H_{33}\cdot CH(NHPh)\cdot CO_2H \longrightarrow C_{17}H_{35}\cdot NH\cdot C_6H_5.$$

The compound crystallises from alcohol in needles, melting at 42—43°, and boils at 285—286°/35 mm. Its *hydrochloride* melts at 99—100°.

Pentadecylaniline, $C_{15}H_{31}\cdot NH\cdot C_6H_5$, similarly obtained from α-anilinopalmitic acid, $C_{14}H_{29}\cdot CH(NHPh)\cdot CO_2H$, melts at 34—35°, and boils at 271°/40 mm. Its *hydrochloride* melts at 97·5°.

Tridecylaniline, $C_{13}H_{27}\cdot NH\cdot C_6H_5$, obtained from α-anilinomyristic acid, $C_{12}H_{25}\cdot CH(NHPh)\cdot CO_2H$, melts at 23—24°, and boils at 251°/35 mm.

The author is now engaged in the investigation of the application of the above reaction to the preparation of secondary amines, and more particularly of substituted anilines and naphthylamines.

***301. "The wet oxidation of metals. Part I. The rusting of iron." By Bertram Lambert and James Campbell Thomson.**

The work published up to the present time on the subject of the rusting of iron cannot be held to prove the fact that pure iron will not undergo visible oxidation in contact with pure water and pure oxygen. In almost all previous investigations, commercial iron

of the highest obtainable degree of purity has been used, but, from a chemical point of view, the impurities contained in the iron must have been considerable, even in the most favourable circumstances.

The authors have shown that pure iron, prepared from pure ferric nitrate by igniting to form the oxide and subsequently reducing in a pure iridium boat in a current of pure hydrogen, does not show visible oxidation after long exposure to pure water and pure oxygen.

The experiments were carried out in vessels of clear fused silica, the water was distilled in a vacuum from a solution of barium hydroxide, and the oxygen was prepared by the electrolysis of a solution of highly purified barium hydroxide.

It has been shown, further, that iron containing a slight trace of impurity will undergo oxidation under the same conditions, even when there is no possibility of an acid substance being either present or formed during the reaction.

Discussion.

The President asked whether Mr. Lambert had taken any measures to free the electrolytic oxygen from diffused hydrogen before bringing it into contact with the iron. He expressed his conviction that Mr. Lambert had amply proved that iron purified by the method described was not oxidised in contact with water and oxygen.

Sir W. Ramsay suggested that stopcocks, greased at the ends with grease and lubricated with phosphoric oxide in the middle round the bore, held tight. He also pointed out that silica dissolves to some extent in water, and that an acid solution (?) might be formed; but pure iron is not attacked by strong acids, and a priori would not be attacked by water.

Professor Armstrong expressed the opinion that the results brought forward in no way affected the conclusions arrived at by Moody and confirmed by Friend. It was to be expected, on theoretical grounds, that iron would not be attacked to any appreciable extent if highly purified; action should take place only in presence of a relatively electronegative conductor, such as platinum; in point of fact, the results arrived at were such as should be arrived at, and were in no way surprising. That rusting would take place under the conditions described if impure iron were used was also to be expected; in carrying out the experiments, apparently, no proper care had been taken to exclude carbon dioxide; it was well known that this gas was obstinately retained by glass surfaces and could not be removed by mere evacuation.

The speaker also suggested that the term "purified" should be used instead of "pure" throughout the communication.

Mr. Arnold Philip asked whether the authors had tried the action of pure oxygen and water on a mixture of two portions of the same sample of pure iron, one of which portions had been strained mechanically, for instance, by hammering, and the other portion being retained in an unstrained condition. It occurred to him that such a mixture might behave similarly to the mixture of pure iron with traces of platinum described by the authors.

Mr. Lambert, in reply to the President, said that the construction of the electrolytic cell precluded the possibility of the diffusion of hydrogen into the oxygen; any hydrogen which diffused back from the cathode must escape into the reservoir of the cell.

In reply to Sir W. Ramsay, he stated his opinion that a glass stopcock, treated as suggested, would not prevent a slow leakage of gas round the barrel of the stopcock if it were lubricated with phosphoric acid, and if the conditions were such that there was a wet gas on one side of the stopcock and a high vacuum on the other side; in time the lubricant must be partly washed away. There was no question of leakage from the outside of the stopcock, since it was mercury-sealed.

In reply to Professor Armstrong, he said that he could not agree that the experiments did not affect the conclusions arrived at by Moody. Moody's contention was that pure iron would only undergo oxidation in contact with water and oxygen when carbon dioxide, or some such acid gas, is present; that, in the absence of this last condition, pure iron will not rust. Moody's experiments were conducted with impure iron and air which was only freed from acid gases; the conditions of experiment were further complicated by his method of treating the iron, so that no simple conclusion could be drawn from his experiments, and certainly none which could be applied to pure iron. Mr. Lambert said that experiments (an account of which was shortly to be presented to the Society) which had been carried out since this paper had been submitted showed that pure iron, made according to the method described in the paper, could be exposed to water and ordinary air without undergoing oxidation—a result which showed that Moody's contention was not true.

With regard to the use of the term "pure," such a term could only be used with a relative meaning in chemistry.

Experiments on the lines of Mr. Philip's suggestion had not been carried out.

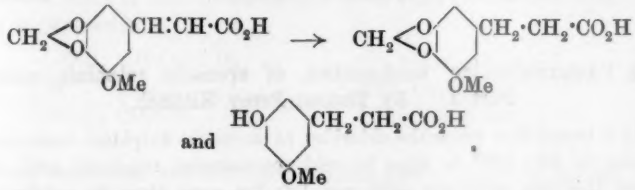
302. "The colour and constitution of diazonium salts. Part III. The diazo-derivatives of 2:7-naphthylenediamine." By Gilbert T. Morgan and Frances M. G. Micklethwait.

Both the amino-groups of 2:7-naphthylenediamine can be diazotised by operating with sodium nitrite or nitrosyl sulphate in moderately concentrated sulphuric acid. The addition of ether and alcohol to this solution caused the precipitation of *naphthalene-2:7-bisdiazonium sulphate*, $C_{10}H_6(N_2\cdot HSO_4)_2,\frac{1}{2}C_2H_5\cdot OH$ (compare Kaufler and Karrer, *Ber.*, 1907, **40**, 3263). This salt was utilised in the preparation of *naphthalene-2:7-bisdiazonium platinichloride*, $C_{10}H_6(N_2)_2PtCl_6,2H_2O$, *aurichloride*, $C_{10}H_6(N_2\cdot AuCl_4)$, and *dichromate*, $C_{10}H_6(N_2)_2{:}Cr_2O_7$. These bisdiazonium salts are decomposed quantitatively by sodium azide, yielding 2:7-*bistriazonaphthalene* (*naphthylene-2:7-bisazoimide*), $N_3\cdot C_{10}H_6\cdot N_3$ (m. p. 98°), and when subjected to the Sandmeyer reaction in presence of hydrochloric acid they furnish 2:7-dichloronaphthalene (m. p. 114°).

These results were employed in the discussion of the authors' views on the constitution of diazonium salts.

303. "Action of sodium amalgam on methylene ethers." By Arthur Henry Salway.

The author has investigated the action of sodium amalgam on 3-methoxy-4:5-methylenedioxycinnamic acid, and has found that the normal reaction is accompanied by a secondary change involving the disruption of the methylenedioxy-complex and the formation of β-5-hydroxy-3-methoxyphenylpropionic acid, according to the following scheme:



A similar change was shown to be general in the case of those aromatic methylene ethers which contain an aliphatic side-chain unsaturated in the αβ-position with respect to the benzene nucleus.

304. "The homogeneous decomposition of ozone in the presence of oxygen and other gases." By David Leonard Chapman and Herbert Edwin Jones.

The authors have continued the work of Clarke and Chapman, in which it was shown that the decomposition of ozone in glass vessels of a sufficient size is a homogeneous change.

The results obtained have demonstrated that:

(*a*) Oxygen, nitrogen, carbon dioxide, and possibly water vapour have no effect on the rate of decomposition of ozone, that is, the rate of decomposition of ozone in the presence of these gases is a function of the concentration of the ozone only.

(*b*) Nitrogen peroxide (Andrews) and chlorine accelerate in a marked degree the decomposition of the gas.

(*c*) If the order of the change can be represented exactly by an integral ordinal number, that number is the second.

305. "The addition of bromine to unsaturated compounds. Part II." By John Joseph Sudborough and John Thomas.

The addition of bromine to the following acids in carbon tetrachloride solution at 15° has been studied: Cinnamylideneacetic and *allo*cinnamylideneacetic acids, sorbic and hydrosorbic acids, the three dihydrocinnamylideneacetic acids, and crotonic, angelic, tiglic, β-dimethylacrylic, and trimethylacrylic acids.

The results confirm the conclusion already drawn, namely, that acids with an olefine linking in the $\alpha\beta$-position react with bromine much less readily than isomeric $\beta\gamma$- or $\gamma\delta$-acids.

The presence of several methyl groups in the acrylic acid molecule facilitates the addition of bromine to the acid.

306. "Intermolecular condensation of aromatic sulphinic acids Part I." By Thomas Percy Hilditch.

It is found that when the chlorides of aromatic sulphinic acids are heated to 60—100° or kept in cold concentrated sulphuric acid, or when the free sulphinic acids are left for some time in sulphuric acid solution, a decomposition takes place, the nature of which is chiefly determined by the substituents in the aromatic nucleus. Thus, in general, those acids in which the para-position with respect to the sulphinyl group is unsubstituted give varying proportions of insoluble compounds of high melting points and of the corresponding disulphoxide, whilst if that position is occupied, small amounts of

disulphoxide only are formed. With the heated sulphinyl chlorides, disulphides may appear with, or in place of, the disulphoxides.

The insoluble derivatives possess the composition :

$$R\cdot C_6H_3{:}S_2O_2{:}C_6H_3\cdot R,$$

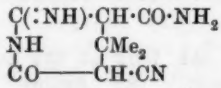
and were found to be closely connected with the insoluble by-products nearly always formed in syntheses of thianthrene. It has further been proved that the insoluble product thus obtained from benzenesulphinic acid is analogous to the "*iso*thianthrene" described by Genvresse, and that, since *p*-dichlorobenzene and benzene-*p*-disulphonyl chloride result from the action of phosphorus pentachloride on the compound, the sulphur atoms are united to each benzenoid residue through the para-carbon atoms. It is accordingly suggested that the term "*iso*thianthrene" be replaced by the more appropriate "parathianthrene."

On account of the sparing solubility and volatility of these derivatives, it has been impossible to determine the molecular complexity of the parathianthrenes, but further proof of their para-configuration lies in their non-appearance from any para-substituted sulphinic acids.

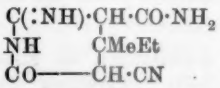
307. "Formation of a six-membered ring through the agency of the imino-group." (Preliminary note.) By Ferdinand Bernard Thole and Jocelyn Field Thorpe.

It is found that an open chain of five carbon atoms and one nitrogen atom readily passes into the six-membered ring through the agency of the imino-group.

Thus, when acetone is condensed with cyanoacetamide in the presence of piperidine or sodium hydroxide, an almost quantitative yield of the imino-imide (I) is formed, and when methyl ethyl ketone is used in place of acetone an equally good yield of the imino-imide (II.) is produced.

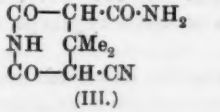


(I.)

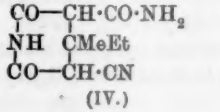


(II.)

These substances are tautomeric imino-amino- (ketimino-enamic) derivatives, which are quickly hydrolysed by dilute mineral acids, forming the imides (III.) and (IV.) respectively.



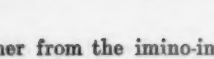
(III.)



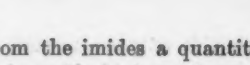
(IV.)

Either from the imino-imides or from the imides a quantitative yield of the $\beta\beta$-substituted glutaric acid is formed on acid hydrolysis.

The imino-imides (I.) and (II.) undergo a further imino-condensation when treated with sodium ethoxide, yielding the di-imino-di-imides (V.) and (VI.).

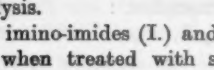


(V.)

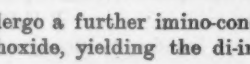


(VI.)

These substances are tautomeric di-iminodiamino-compounds, which are readily hydrolysed by dilute mineral acids, forming the di-imides (VII.) and (VIII.) respectively.



(VII.)

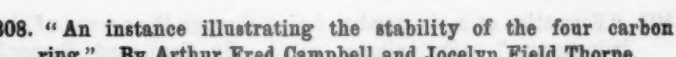


(VIII.)

These compounds are also converted into the corresponding dialkylglutaric acids on complete acid hydrolysis.

308. "An instance illustrating the stability of the four carbon ring." By Arthur Fred Campbell and Jocelyn Field Thorpe.

It was shown that under the same experimental condition that produce ethyl $\alpha\alpha$-dicyanoadipate from ethyl 1-cyano*cyclo*propane-1-carboxylate and ethyl cyanoacetate, the corresponding *cyclo*butane derivative, ethyl 1-cyano*cyclo*butane-1-carboxylate (I), is converted into an imino-compound (II.).



(I.) (II.)

The derivatives of this imino-compound were described.

309. "Narcissine: an alkaloid from the bulb of the common daffodil (Narcissus Pseudonarcissus)." By Arthur James Ewins.

A new alkaloid, *narcissine*, has been isolated from the bulb of the common daffodil (*Narcissus Pseudonarcissus*). It has been shown to possess the formula $C_{16}H_{17}O_4N$, melts at 266—267°, and is lævorotatory ($[\alpha]_D$ −95·8°). It contains no methoxy-groups, and is characterised by great stability.

The *hydrochloride*, $C_{16}H_{17}O_4N,HCl$, was also described.

310. "Preparation of ammonium nitrite by the sublimation in a vacuum of a mixture of ammonium chloride and alkali nitrites." By Pañchañan Neogi and Birendra Bhusan Adhicāry.

The authors have prepared in fairly large amount the unstable compound, ammonium nitrite, by evaporating and subliming in a vacuum a concentrated solution of ammonium chloride and alkali nitrites. The method of preparation of the compound, its properties, and the results of vapour density determinations by Hofmann's method at different temperatures were described.

311. "The action of halogens on mercuricamphor compounds." By James Ernest Marsh.

Di-iodocamphor is formed by the action of iodine on each of the three mercuricamphor compounds, $C_{10}H_{14}O,Hg_2I_2$, $(C_{10}H_{14}O)_3Hg_4I_2$, and $(C_{10}H_{14}O)_4Hg_5I_2$. Di-iodocamphor is decomposed in solution by the oxygen of the air with liberation of iodine and formation of camphorquinone. Di-iodocamphor and the mercuricamphors are thus shown to be $\alpha\alpha'$-derivatives of camphor. The action of bromine on dimercuricamphor compounds and on di-iodocamphor gives $\alpha\alpha'$-dibromocamphor.

312. "The absorption spectra of various diketopyrroline compounds." By John Edward Purvis.

The results of this investigation show that (1) the diketonic structure gives rise to the production of a well-marked colour and absorption; (2) the introduction of a methyl or a propyl group in an aromatic side-chain produces no fundamental change in the colour or the absorption; (3) the introduction of an anisyl or a piperonyl group in an aromatic side-chain does not fundamentally alter the colour or the corresponding absorption; but another more refrangible band is produced characteristic of each type of radicle; (4) the replacement of oxygen in a ketonic group by phenylhydrazine produces a change in the colour and the absorption, so that two bands are developed, the less refrangible one being the stronger; (5) the replacement of both oxygen atoms and the establishment of a phenazine ring is marked by a further change in the colour from red to yellow, a decrease in the strength of the less refrangible band, and an increase in the strength of the more refrangible one; (6) the increased weighting of the molecule shifts the positions of general absorption towards the more refrangible regions.

313. ‘ Studies of the processes operative in solutions. Part XII. The apparent hydration values of acid-systems and of salts deduced from a study of the hydrolytic activities of acids.” By Frederick Palliser Worley.

An account was given of an extended series of observations on the behaviour of cane-sugar in aqueous solutions towards chlorhydric and nitric acids, and of the influence of salts on the rate of change. The results were discussed with reference especially to the determination of the apparent hydration value of the solutes.

314. “Studies of the processes operative in solutions. Part XIII. The depression of the hydrolytic activity of acids by paraffinoid alcohols and acids.” By Henry E. Armstrong and Frederick Palliser Worley.

It was shown that the depressant influence increases as the molecular weight of the depressant increases.

315. “Studies of the processes operative in solutions. Part XIV. The determinations of apparent hydration values by means of raffinose.” By Walter Hamis Glover.

The values arrived at when raffinose is hydrolysed in presence of salts were shown to be practically identical with those obtained on using cane-sugar as hydrolyte.

316. “Studies of the processes operative in solutions. Part XV. The changes effected by the reciprocal interference of sugar (and glucosides) and salts in aqueous solutions.” By Walter Hamis Glover.

This communication is an extension of the work described in Part X (*Proc. Roy. Soc.*, 1908, **81**, *A*, 117), in which the effect of cane-sugar on the rotatory power and electrical conductivity of solutions of various salts was considered. The sugars studied are raffinose, together with melibiose, milk sugar and α- and β-methyl-glucoside.

317. “Studies of the processes operative in solutions. Part XVI. The determination of optical rotatory power.” By Frederick Palliser Worley and Walter Hamis Glover.

Various refinements were described that have been made use of in carrying out the determinations described in Parts XII.—XIV.

318. "Studies of the processes operative in solutions. Part XVII. The relative efficiencies of acids as deduced from their conductivities and hydrolytic activities (II)." By Henry E. Armstrong and Edward Wheeler.

The acids studied are chlorhydric, bromhydric and iodhydric—the acids formed by the dissolution of the three hydrides HCl, HBr, HI.

319. "Studies of the processes operative in solutions. Part XVIII. The depression of electrical conductivity by non-electrolytes." By Henry E. Armstrong and David Crothers.

Results were given showing the effects produced at 0° and 25°. Attention was particularly directed to the remarkable manner in which the depressant effect increases as the molecular weight of the depressant increases.

320. "Studies of the processes operative in solution s.Part XIX. The complexity of the phenomena afforded by solutions: a retrospect." By Henry E. Armstrong.

A summary was given of the results recorded in previous communications of the series and their bearing on the problems afforded by solutions was discussed.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Michaelis, *Leonor.* Dynamik der Oberflächen. pp. iv + 88. Dresden 1909. (*Recd.* 3/11/10.) From the Author.

Molinari, *Ettore.* Trattato di chimica inorganica. pp. xvii + 924. ill. 3rd edition. Milano 1910. (*Recd.* 7/11/10.) From the Publisher: Ulrico Hoepli.

Villavecchia, *Vittorio.* Dizionario di merceologia e di chimica applicata. 3rd edition. Vol. I, A–M. pp. xv + [779]. Milano 1910. (*Reference.*) From the Publisher: Ulrico Hoepli.

II. *By Purchase.*

Grimmer, *W.* Chemie und Physiologie der Milch. pp. xii + 364. ill. Berlin 1910. (*Recd.* 16/11/10.)

Herzog, *Alois.* Die Unterscheidung der natürlichen und künstlichen Seiden. pp. 78. ill. Dresden 1910. (*Recd.* 16/11/10.)

Holleman, *A. F.* Die direkte Einführung von Substituenten in den Benzolkern. Ein Beitrag zur Lösung des Substitutionsproblems in aromatischen Verbindungen. pp. vi + 516. Leipzig 1910. (*Recd.* 16/11/10.)

Richter, *Max Moritz.* Lexikon der Kohlenstoff-Verbindungen. Lieferung I. 3rd edition. pp. 160. Hamburg 1910. (*Reference.*)

Schwalbe, *Carl G.* Die Chemie der Cellulose. Part I. pp. 272. Berlin 1910. (*Recd.* 16/11/10.)

III. *Pamphlets.*

Gortner, *Ross Aiken.* On some new quinazoline derivatives. pp. 49. Easton, Pa. 1909.

Gutbier, *A.*, and **Bünz**, *R.* Zur Kenntnis der Wismutperoxyde. (From the *Sitzungsber. Physik.-Med. Soz. Erlangen*, 1908, **40**.)

Hämäläinen, *Juho.* Ueber isomere Borneolglykuronsäuren. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Zur Spaltbarkeit der Borneol- und Camphoglykuronsäuren durch Enzyme. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Heyl, *Georg.* Ueber die Alkaloide von Corydalis solida Sm. (From the *Apoth. Zeit.*, 1910, **25**.)

—— Ueber Corydalis aurea. (From the *Apoth. Zeit.*, 1910, **25**.)

Hintz, *E.* Ueber den Arsengehalt der Maxquelle zu Bad Dürkheim a.d. Haardt. (From the *Zeitsch. Balneol.*, 1910, **3**.)

Holsti, *Östen.* Zur Kenntnis des Phosphorumsatzes beim Menschen. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

Hooper, *David.* The secretion of *Phromnia marginella*, Olivier. (From the *J. Proc. Asiatic Soc. Bengal*, 1909, N.S. 5.)

Imperial Institute. Selected Reports from the Scientific and Technical Department. II. Gums and Resins. III. Foodstuffs. pp. 136 to 203, 200 to 267. London 1909, 1910.

Indian Association for the Cultivation of Science. Report for the year 1908. pp. 65. Calcutta 1909.

Jänecke, *Ernst.* Legierungen. pp. 100. ill. Hannover 1910.

Krogh, *August*, and **Krogh**, *Marie.* The mechanism of gas-exchange. I–VII. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Lehmann, *F.* Ueber den einfachsten Modus der Zuckerbestimmung in Harn. (From the *Apoth. Zeit.*, 1910, **25**.)

Luzzatto, *R.*, and **Satta**, *G.* Intorno al comportamento nell' organismo animale dei Jodoso-, Jodil e Jodonio-composti. I. Comportamento del Jodoso-benzolo. (From the *Arch. Farm. sperim.* 1909, **8**.)

Meyer, *J. de.* Allgemeine Bemerkungen über die glykolytischen Prozesse unter Bezugnahme auf die Arbeiten der Herren Stoklasa, Oppenheimer und Rosenberg. (From the *Zentr. Physiol.*, 1910, **23**.)

Meyer, *Julius.* Bemerkungen über die Fermente der Milch. (From the *Arbeiten aus dem Kaiserl. Gesundheitsamte*, 1910, **34**.)

Moir, *James.* Genetic connexions between the chemical elements. (From the *S. African J. Sci.*, 1910.)

Motolese, *Francesco.* Sulle proprietà farmacologiche dell'acido picrico. (From the *Arch. Farm. sperim*, 1910, **9**.)

Neuberg, *Carl.* Verhalten von racemischer Asparaginsäure bei der Fäulnis. (From the *Archiv. Fisiol.*, 1909, **7**.)

Neuberg, *Carl.* Zur Frage der Pigmentbildung. (From the *Zeitsch. Krebsforschung*, 1909, **8**.)

Oesterle, *O. A.*, and **Riat**, *G.* Zur Kenntnis des Aloins. (From the *Schweiz. Woch. Chem. Pharm.*, 1909.)

Patta, *Aldo.* Contributo allo studio della supposta azione ricostituente dei fosfati, dei glicero fosfati, delle lecitine sopratutto in condizioni di esaurimento e di depressione del sistema nervoso e del ricambio. pp. 83. Pavia 1909.

——— Osservazioni intorno al comportamento degli ipofosfiti nell' organismo. (From the *Arch. Farm. sperim.*, 1910, **8**.)

Rancken, *Dodo.* Ueber die Einwirkung der Massage auf den Eiweissumsatz im Organismus. (From the *Skand. Arch. Physiol.*, 1910, **23**.)

Reis, *Robert.* Phytochemische Untersuchung der Erythraea Centaurium Pers. pp. 46. Strassburg 1909.

Royal Society of Arts. Directory. Edited by *Sir Henry Trueman* **Wood**. pp. 76. London 1909.

Runne, *Ernst.* Titration von Alkaloidsalzen. (From the *Apoth. Zeit.*, 1909, **24**; 1910, **25**.)

Rupp, *E.*, and **Klee**, *W.* Ueber die Darstellung von Sublimat aus Quecksilbersulfat und Kochsalz auf nassem Wege. (From the *Apoth. Zeit.*, 1910, **25**.)

Rusconi, *Arnaldo.* Sulla ricerca dell'agrostemma nelle farine alimentari e nel pane col metodo dell' emolisi. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

—— L'emolisi come mezzo analitico per la ricerca delle saponine nella birra, nelle acque gazose, e nei vini. (From the *Boll. Soc. Med.-Chir. Pavia*, 1910.)

Santesson, *C. G.* Ueber die Einwirkung von Giften auf einen enzymatischen Prozess. (From the *Skand. Arch. Physiol.*, 1909, **23**.)

—— Ueber die Wirkung von Kaliumbromat. (From the *Arch. Fisiol.*, 1909, **7**.)

Scherer, *Hermann.* Ueber Phytosterine und einige fette Oele. pp. 63. Mülhausen i. E. 1909.

Serono, *Cesare.* Metodo per la preparazione dei Metalli colloidali stabili. (From the *Arch. Farm. sperim.*, 1910, **9**.)

RESEARCH FUND.

A Meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 5th, 1910.

All persons who received grants in December, 1909, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Thursday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday**, December 1st, 1910, at **8.30** p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The triazo-group. Part XV. Triazoethylene (vinylazoimide) and the triazoethyl halides." By M. O. Forster and S. H. Newman.

"The determination of solubility coefficients by aspiration. Preliminary note." By W. J. Jones.

"The auto-reduction of hydrazines." F. D. Chattaway and M. Aldridge.

"The nitro-derivatives of dimethyl-*p*-toluidine." By G. T. Morgan and A. Clayton.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, December, 1st, 1910.

Applebey, Malcolm Percival,
Hill View, Foxcombe, near Oxford.

Fereday Fellow, St. John's College, Oxford. Part author of paper on "Some Physico-chemical Properties of Mixtures of Pyridine and Water" (Trans., 1908, p. 538). Research Assistant to the Earl of Berkeley.

Berkeley. N. V. Sidgwick.
E. G. J. Hartley. H. T. Tizard.
H. Hartley.

Banerjee, Manindranath,
3, Padmanath Lane, Shambazar, Calcutta.

Senior Lecturer of Chemistry, Bengal National College, Calcutta. Author of a series of papers entitled "India—through her Industries: I. Nitre Industry in Tirhut (Bengal)," being published in the *Modern Review* since May, 1910. Communicated a paper "On a Simple and Convenient Apparatus for the Determination of Equivalents of Metals and the Estimation of Carbon Dioxide both Directly and Indirectly," to the Chemical Society in May, 1910. Serving as Senior Lecturer in Chemistry and head of the Chemistry Department of the Bengal National College and School, Calcutta (India), since 1906. Studied three years in the Civil Engineering Department of the Government C. E. College, Sibpur (Bengal).

Paul Brühl. P. C. Rây.
Jyoti Bhushan Bhaduri. *Amrita Lal Sircar.*
Chuni Lal Bose.

Barwick, Fred Wilkinson,
Rathlyn, Kilmorey Gardens, St. Margaret's-on-Thames.

Senior Assistant and Mercers' Research Fellow, Scientific and Technical Department, Imperial Institute, London; now appointed

Manager, Public Textile Testing House, Technical Institute, Belfast. Associate, Bradford Technical College. Has specialised in the examination and testing of vegetable and animal fibres and textile materials.

Wyndham R. Dunstan. Ernest Goulding.
Thomas Anderson Henry. Henry H. Robinson.
Saml. S. Pickles.

Bhattacharya, Sarat Chandra, M.A.(Calcutta),
Hazaribagh, Bengal, India.

Professor of Chemistry, St. Columba's College, Hazaribagh. Passed the M.A. examination of Calcutta University from Hughli College in 1895. Has been a successful teacher of Chemistry for the last twelve years.

J. A. Cunningham. Bidhu Bhushan Dutt.
P. C. Rây. *Jyoti Bhushan Bhaduri.*
David Hooper.

Bosworth, Stewart McGregor,
65, Abingdon Villas, Kensington, W.

Chemical Assistant to J. Y. Buchanan, Esq., F.R.S., at Davy-Faraday Research Laboratory. Bachelor of Science (London); Member of the Pharmaceutical Society of Great Britain; sometime Assistant to Dr. H. Wilson Hake at Westminster Hospital Medical School; assisted in a Research on the "Hydrochloric Acid in Gastric Contents of Mice," which was published in the Royal Society's Proceedings: also in a Research on the "Poisonous Gases evolved from Ferro-Silicon," published in the Local Government Report, 1909, etc.

Alexander Scott. A. Liversidge.
J. Y. Buchanan. H. Wilson Hake.
Hugo Müller.

Bracher, André,
30, Guilford Street, London, W.C.

Analytical Chemist. Assistant for five years to A. W. Stokes, Esq., F.I.C., F.C.S. (Public Analyst). Student four years, Polytechnic, Regent St. (Chemistry, etc.). Present position, Analyst to Dairy Supply Co., Ltd., Museum St., W.C.

Frank E. Weston. Cecil Revis.
Wm. Hy. Collier. H. R. Ellis.
Alf. W. Stokes. John Wilson.

Brady, Frederick Hugh Rochfort,

12, Park View Avenue, Harolds Cross, Dublin.

Chemist. Pharmaceutical Chemist, Ireland, by examination.

Henry I. Gorman.	*Thomas Tyrer.*
Henry Boyers.	*Philip F. Rowsell.*
John Gerard Hughes.	*C. G. Moor.*

Briggs, John C.,

East View or Gas Works, Workington.

Gas Engineer. Assistant Engineer and Chemist, Workington Corporation Gas Dept. Consulting Engineer to a number of small gas undertakings. Member Society Chemical Industry. Graduate Inst. Mech. Engineers. Honoursman: Gas Engineering, Manufacture and Distribution, and other Science subjects. Varied experience and investigations as Consultant in the Chemistry of Gas manufacture and by-products, and the design of apparatus.

Jas. D. Dougall.	Pattinson B. Melmore.
Frank Wood.	*W. H. Watson.*

J. Robinson.

Briscoe, Henry Vincent Aird,

33, Bargery Road, Catford, S.E.

Professor's Assistant in the Royal College of Science (Department of Chemistry). Associate of the Royal College of Science (in Chemistry); Bachelor of Science (London).

T. E. Thorpe.	G. T. Morgan.
M. O. Forster.	James C. Philip.

F. P. Dunn.

Brown, John,

Technical Institute, Timaru, New Zealand.

Director of Agricultural Instruction. B.Sc. (Glasgow). Four years training in the Chemical laboratories of Glasgow University and the West of Scotland Agricultural College; formerly lecturer on Agriculture and on Soils and Manures in the West of Scotland Agricultural College, and expert on Manures and Feeding Stuffs to the County Gentlemen's Association; now in charge of the laboratory of the Technical Institute, Timaru, and conducting investigations in the department of agricultural chemistry.

H. W. Potts.	R. A. Berry.
Robt. D. Watt.	H. H. Green.

Cecil H. Desch.

Buttle, Bertram Haward,

63, Claremont Road, Forest Gate, London, E.

Science Master, Archbishop Holgate's School, York. Two contributions to the Society, jointly with Dr. J. T. Hewitt: "Solubility of Silver Chloride in Mercuric Nitrate," and "Constitution of Polynitrophenols in Alkaline Solution."

J. T. Hewitt. Clarence Smith.
F. G. Pope. F. S. Long.
C. Müller.

Camp, Frank Anthony,

c/o Parry & Co., Madras, India.

Chemist. Analyst to Messrs. Parry & Co., Sugar Refiners, Madras; formerly Assistant Chemist to Messrs. Garton, Hill & Co., Battersea.

Leonard Temple Thorne. Charles A. Keane.
B. E. R. Newlands. E. Haynes Jeffers.
J. C. Crocker.

Challenger, Frederick,

324, Mansfield Road, Carrington, Nottingham.

Research Student in Organic Chemistry. B.Sc. (Lond.); A.I.C.; 1851 Exhibition Scholar, 1910. Educated at Ashville College, Harrogate. Obtained London B.Sc. (Honours) in Chemistry after three years' work at Derby Technical College. Research Scholarship at University College, Nottingham, since Jan., 1908. Publications —jointly with Prof. F. S. Kipping, F.R.S.—"Organic Derivatives of Silicon. Part XII"; "Dibenzylethylpropylsilicane and Sulphonic Acids derived from it. Part XIII"; "Optically Active Compounds containing One Asymmetric Silicon Group." Unpublished research on "Organic Derivatives of Phosphorus." Proceeding to University of Göttingen in Oct., 1910, to work under Prof. Otto Wallach.

F. Stanley Kipping. R. M. Caven.
Henry J. S. Sand. W. N. Haworth.
J. H. A. Hebron. A. Jamieson Walker.

Colgate, Reginald Thomas,

Bromfield, 26, Birdhurst Rise, S. Croydon.

Assistant Demonstrator. Now occupying post as Lecture-Assistant at City and Guilds Institute, Central Technical College. Joint author (with Mr. E. H. Rodd) of Paper communicated to the Society, June, 1910: "Sulphonic Derivatives of the 1:4-Di-derivatives of Benzene containing Halogens."

Henry E. Armstrong. J. Vargas Eyre.
T. Martin Lowry. W. Robertson.
Fredk. P. Worley.

Coslett, Thomas Watts,

Steel Road, Northfield, Worcestershire.

Inventor and Patentee of the Coslett Anti-Rust Process. Author of Papers relating to the above method. Interested in Chemical Science generally, especially with regard to oxidation of metals.

H. W. Jones. Arthur Adams.
Harry Silvester. *R. Lloyd Whiteley.*
F. M. Thomas.

Crawford, David Chalmers,

Elsenburg, Mulders Vlei, Cape Colony.

Lecturer in Chemistry, Government College of Agriculture, Elsenburg. Graduate of Aberdeen University; M.A., B.Sc., B.Sc.Agr. Lecturer in Chemistry, and Analytical Chemist, Elsenburg.

James Hendrick. F. R. Japp.
George N. Blackshaw. *James Moir.*
E. V. Flack.

Davies, John Hughes,

St. Peter's College, Peterborough.

Vice-Principal of St. Peter's College (for the Training of Teachers), Peterborough. B.Sc. (Univ. of Wales); Ph.D. (Univ. of Leipzig); formerly 1851 Exhibition Scholar, and Assistant in Physical Chemistry at Leipzig. Have published several scientific researches:—Perman and Davies: *Proc. Roy. Soc.*, **76**, p. 173, 1905; *Chem. News*, May 18th, 1906; *Proc. Roy. Soc.*, **78**, p. 28; *Trans. Chem. Soc.*, **91**, p. 1113, 1907. Le Blanc and Davies: *Zeits. f. Elektroch.*, **14**, 361, 1907. Davies: *Proc. Roy. Soc.*, **78**, p. 41, 1906; *Zeits. f. physik. Chem.*, **64**, p. 657, 1908; Inaug. Dissert., Univ. of Leipzig, 1908.

Claude M. Thompson. E. P. Perman.
Robt. D. Abell. Norman Picton.
F. P. Armitage.

Dodd, Arthur,

"Lyndhurst," Belvedere, Kent.

Manager of Messrs. C. Price & Co.'s Oil Works at Belvedere. I have been engaged in practical oil refining and manufacture of oil products for the last 16 years, and am desirous of following chemical literature by studying papers appearing in the Journal of the Chemical Society.

J. Lewkowitsch. Wesley Lambert.
Robert Redwood. J. B. Gall.
L. Myddelton Nash. *H. Heron Smith.*

Duncan, James Hugh,

18, Park Place, Cardiff.

Analytical and Consulting Chemist. For last two years general partner of Treharne and Duncan, Analytical and Consulting Chemists, 125, Bute Street, Cardiff. Student for four years at Merchant Venturer's Technical College, Bristol. Sat for London B.Sc. Hons. in Chemistry, obtaining exemption from Pass Exam. in that subject. Obtained Second Class Hons. in Practical Chemistry Board of Education. Desires making extended use of your library and publications.

J. Wertheimer. F. Gwilym Treharne.
F. W. Rixon. *Bernard Dyer.*
H. Stanley. *Frank W. G. King.*

Emmett, William Gidley,

Caius College, Cambridge.

Student. Nat. Sciences Tripos, Pt. I., 1st Class; Pt. II. (Chemistry), 2nd Class. Formerly Scholar of Gonville and Caius College, Cambridge. Engaged in research.

H. O. Jones. Charles T. Heycock.
W. J. Pope. H. J. H. Fenton.
J. G. M. Dunlop.

Ensor, Ainslie Jackson, B.Sc. (Birm.),

67, Cannon St., Wellingboro', Northants.

Principal, Wellingborough Technical Institute. 1903–1906, Student University of Birmingham; 1906–1908, Tutor (Science) Training College for Men, Univ. of Birm.; Demonst. Chemistry, Sutton Coldfield Tech. School, 1906–1908; also at Selly Oak and Stirchley.

Percy F. Frankland. C. K. Tinkler.
Alex. Findlay. Alex. McKenzie.
Henry Wren.

Finlayson, John George,

13, Monarch Terrace, Blaydon-on-Tyne.

Cambridge University, Natural Sciences Tripos, Part I, June, 1907. Science Master, Blaydon Secondary School. Instructor in Chemistry, Durham County Council.

Charles T. Heycock. Henry Jackson.
W. J. Pope. Duncan T. Richards.
W. J. Sell. *Arthur J. Berry.*
J. E. Purvis.

Goddon, George Alexander,

18, Rylett Crescent, Shepherd's Bush, W.

Manufacturing Chemist. Am desirous of coming in touch with current scientific literature.

C. T. Bennett.	Edwin Harrison.
W. Carter White.	Ernest J. Parry.

John C. Umney.

Holt, Fred, B.Sc.,

28, Mere Street, Rochdale.

Research Student. Studied Chemistry for three years in the University of Manchester. First Class Honours B Sc. Examination. Working in the Research Laboratories.

Harold B. Dixon.	Alfred Holt, jun.
W. H. Perkin.	Norman Smith.
A. Lapworth.	Ch. Weizmann.

Knecht, Edmund, M.Sc. Tech. (Manch.) Ph.D.,

Municipal School of Technology, Manchester.

Professor of Technological Chemistry in the University of Manchester. Author of many papers in the *Berichte*, etc., on the Theory of Dyeing and on Analytical Chemistry.

Harold B. Dixon.	R. Robinson.
W. H. Perkin.	Ch. Weizmann.
Norman Smith.	E. C. Edgar.
H. F. Coward.	A. Lapworth.

Arthur W. Crossley.

Khan, Prince Mahmood Ali,

Zafermanzl, Rampur State, U.P., India,

Late Personal Assistant to H.H. the Nawab of Rampur. Chief Excise Officer. Chief Officer of Foreign Property. (1) B.A. Western University; (2) Diploma in Dairying, University College, Reading; (3) Diploma in Agriculture, University College, Reading; (4) B.D.F.A. Certificates in Butter and Cheese; (5) Desirous of keeping in touch with the advance of Chemical Science; (6) N.D.D. Royal Agricultural Society of England; (7) B.D.F.A. Diploma.

J. K. H. Inglis.	J. W. Dodgson.
P. C. Austin.	John W. Tayleur.

C. W. Walker-Tisdale.

Knight, William Arthur,

5, The Green, Marlborough.

Assistant Master at Marlborough College. M.A. Cantab.

F. Francis.	Reginald G. Durrant.
F. W. Rixon.	J. E. S. Tuckett.

Arthur W. Crossley.

Lambert, Bertram, M.A.,
34, Leckford Road, Oxford.

Lecturer and Demonstrator in Chemistry in the University Laboratories.

William Odling. Harold Hartley.
J. E. Marsh. John Watts.
D. H. Nagel. Allan F. Walden.
F. D. Chattaway.

Low, Kenneth Stewart,
3, Luxemburg Gardens, London, W.

Metallurgist and Assayer. Educated at St. Paul's School. First studied Chemistry at the S.W. Polytechnic—passed Sessional Examination and obtained Certificate of Merit; afterwards at Royal College of Science (passed Chemistry, Part I., theoretical and practical); and Royal School of Mines (Assaying and Metallurgy, theoretical and practical, Parts I. and II.); Associateship (Metallurgy, 1906). Assistant Assayer with Messrs. J. S. MacArthur & Co., Glasgow. Research Chemist with Messrs. C. Pass & Son, Bedminster Smelting Works, Bristol; and for the past three years Chief Chemist and Assayer to the Penhalonga Proprietary Mines, Ltd.

W. Gowland. G. T. Morgan.
F. W. Harbord. W. H. Merrett.
E. O. Courtman.

Lowe, Clement Ward,
Thorneyholme, Knutsford, Cheshire.

Manufacturing Chemist. Fellow of the Institute of Chemistry (1891). Member of the Society of Arts. Member of the Society of Chemical Industry. I studied Chemistry under Sir Henry Roscoe and the late Mr. Carl Schorlemmer at Owens College, Manchester, for a period of four or five years. During the latter part of the time I was occupied with original work, and acted as a private assistant to the late Mr. Schorlemmer. A paper by me on Dibenzyl Ether was published in the *Journal of the Chemical Society* about the year 1889. Since the death of my father, in 1898, who was one of the earlier Fellows of the Chemical Society, my time has been entirely devoted to the business of manufacturing chemist.

R. Le Neve Foster. Thomas Tyrer.
Watson Smith. *William Crookes.*
William Thomson.

MacGeorge, David Jackson,
Rangoon Refinery Co., Ltd., Thilawa, Burma.

Oilworks Chemist. Four years' training as a student-assistant in

Laboratory of Edinburgh City Analyst; three and a-half years assistant chemist in Scottish Shale Oil Works, Broxburn Oil Co., Ltd.; one year chief chemist Indo-Burma Petroleum Co., Burma; one year chief chemist and assistant manager, Rangoon Refinery Co., Ltd., Burma; am a member Edinburgh University Chemical Society.

J. Falconer King. John M. Guthrie.
John S. Ford. *G. H. Gemmell.*

J. Wyclif Black.

McNish, Malcolm,

Shortsands, St. Neots, Hunts.

Manufacturing Chemist. During the years 1906 and 1907 I studied the Chemistry of Fermentation at the University Chemical Laboratories, Cambridge, and during the years 1908 to 1910 I studied Analytical Chemistry as applied to the above in the laboratory of Mr. Chaston Chapman, 8, Duke St., London, E.C. During two years I have had practical experience in the manufacture of malt extract and other malt products in the works of Messrs. Paine & Co., Ltd., St. Neots, Hunts, and am now engaged in doing analytical work in that firm's laboratory.

Alf. Chaston Chapman. Barth. F. Sawbridge.
Fred. T. Harry. J. E. Purvis.

W. J. Sell.

Majima, Rikō,

37, Linden Garden, Notting Hill Gate, W.

Assistant Professor Chemical Institute, University, Tokio. Author of various papers published in *Berichte*; for example, on "Terpinen," on "Japanese Lack," etc., etc.

Alexander Scott. Hugo Müller.
Edward Divers. James Dewar.

James D. Kettle.

Masson, James Irvine Orme,

2, Chester Street, Edinburgh.

M.Sc. (Melbourne). Student of Chemistry. Formerly Lecturer on Chemistry in Ormond College (Univ. of Melb.); and Victorian Government Research Scholar in Chemistry. Now 1851 Exhibition Research Scholar. Publications:—"The Action of Water of Crystallisation on Calcium Carbide" (*J.C.S., Trans.*, 1910, 851); "The Decomposition of Metallic Cyanates by Water" (jointly with Professor Masson) (*Z.P.C.*, lxx, 290).

James Walker. Alex. C. Cumming.
Orme Masson. Alex. Crum Brown.

William Ramsay.

Merton, Thomas R., B.Sc. (Oxon.).
18, Grosvenor Street, W.

Research Student, Balliol College, Oxford. Dissertation on the "Viscosity and Density of Solutions of Cæsium Nitrate."

John M. Thomson. D. H. Nagel.
Herbert Jackson. Harold Hartley.
N. Garrod Thomas.

Mitchell, Alec Duncan,
"Carnock," Hartley Road, Leytonstone.

Research Assistant. B.Sc. (London, 1908), First Class Honours; formerly Junior Demonstrator at East London College (Univ. of London); Research Assistant to Dr. J. F. Thorpe (Sorby Research Fellow in University of Sheffield); joint author of several papers in Journal of Society (1908, 842; 1909, 1430, 2198, and 1910, 997).

J. F. Thorpe. Clarence Smith.
W. Palmer Wynne. J. Kenner.
J. T. Hewitt. J. J. Fox.
F. G. Pope. H. V. Mitchell.

Mitra, Dhirendranath, B.A. Dip. in Agri. (Shibpur).
89/2, Musjeed Bari Street, Calcutta.

Lecturer in Physics and Chemistry in the College of Physicians and Surgeons, Bengal, and in the Calcutta Medical School. Also Demonstrator in Chemistry, Metropolitan Institution, Calcutta. B.A. in B Course of the Calcutta University, and Agricultural Diploma holder (Shibpur).

Paul Brühl. P. C. Rây.
Bidhu Bhushan Dutt. *Jatindranath Sen.*
Jyoti Bhushan Bhaduri.

Moore, Harold,
84, Kalashnikoff Quay, St. Petersburg.

Post-graduate Student of the Municipal School of Technology, Manchester. B.Sc. Tech. (Manchester). Studied Applied Chemistry for three years at the Municipal School of Technology, Manchester (1906–1909). Also had one year's experience at Research under Professor Knecht.

Stanley J. Peachey. E. L. Rhead.
F. S. Sinnatt. H. F. Coward.
F. G. Richards.

Nair, Valliyil Govindan, B.A. (Madras), B.Sc. Tech. (Victoria),
223, Upper Brook Street, C-on-M., Manchester.

Student, School of Technology, Manchester. Student of the

Presidency College, Madras (India), from 1902 to 1904 under Prof. W. H. Wilson, Ph.D., F.I.C., F.C.S., and took the B.A. Degree in Chemistry in 1905. Worked in the Imperial Agricultural Research Institute, Pusa, India, from 1907 to 1908 under the Fibre Expert, R. S. Finlow, Esq. B.Sc., F.C.S., etc. Student of the School of Technology (Department of Applied Chemistry), Manchester, from 1908 onwards, and took the Degree of B.Sc. Tech. (Victoria) in July, 1910.

Jul. Hübner.	F. S. Sinnatt.
L. G. Radcliffe.	Jas. Grant.
S. J. Peachey.	F. G. Richards.

Myers, James Eckersley, B.Sc.,
"Acresfield," Gatley, Cheshire.

Research Student in the University of Manchester. Student for Three years in the Chemical laboratories of the University of Manchester. B.Sc. with First Class Honours in Chemistry. Engaged in Research.

Harold B. Dixon.	Norman Smith.
W. H. Perkin.	Alfred Holt, jun.
A. Lapworth.	Ch. Weizmann.

E. C. Edgar.

Newman, Sidney Herbert,
181, Brooke Road, Upper Clapton, N.E.

Research Chemist at the Royal College of Science. B.Sc. (London). Formerly Student at the East London College. Joint author of several papers in the Society's Journal.

M. O. Forster.	Frank G. Pope.
J. T. Hewitt.	James C. Philip.
Clarence Smith.	G. T. Morgan.

Paterson, John Hamilton,
Carmyle, Wellington St., Grimsby.

Teacher of Organic Chemistry, and Analyst in private practice. B.Sc. (Dun.), 1902; M.Sc. (Dun.), 1910, by research in Analytical Organic Chemistry. Work done consists of: (1) A method of estimating hydroxyl groups in organic compounds. (2) A method of determining acetic acid in commercial vinegar. (3) An apparatus for the combustion of volatile organic liquids. Recipient of the Saville Shaw Memorial Medal (1902) given by the Soc. of Chem. Ind. for work on selenium.

P. Phillips Bedson.	J. A. Smythe.
S. Hoare Collins.	*Arthur Jaques.*

A. Forster.

Pennington, Alfred John,

"Oakley," Fallowfield, Manchester.

Manufacturing Chemist. Author of "Mineral Waters and their Uses"; "The Practical Mineral Water Manufacturer"; "Notes on the Essential Oils of Commerce," etc., etc. Three years laboratory, James Audley, B.Sc., F.C.S. Two years laboratory, Idris & Co., Ltd., London. Ten years as Manufacturing Chemist, Bratby and Hinchcliffe, Ltd., Manchester, London, and Glasgow.

T. H. W. Idris. Herbert J. Gover.
James A. Audley. M. S. Pickering.
F. R. Stephens.

Posford, Benjamin Ashwell,

"Wood Dene," Kippington, Sevenoaks, Kent.

Analyst. Assistant in the laboratories of Percy Edgerton, Esq., 96, Cheapside, E.C., since 19th October, 1908.

Percy Edgerton. William Ramsay.
F. Mollwo Perkin. *John W. Heath.*
James D. Kettle.

Prasad, Hari,

97, Roseneath Road, Urmston, Manchester.

Bachelor of Arts of the Punjab University. Bachelor of Science of the Victoria University of Manchester. Student for two years in the Chemical Dept. of the University of Manchester.

Harold B. Dixon. E. C. Edgar.
W. H. Perkin. Alfred Holt, jun.
Norman Smith.

Ramsden, Frederick Valentine,

Alexandra Street, E. St. Kilda, Victoria.

Assayer. Student Assistant, H. W. Levy (10 months). Student Assistant, Mines Department Laboratory, Victoria (13 months). Assistant, H. W. Levy, F.C.S. (15 months). Assistant, Mines Department Laboratory (9 months). At present Assistant Assayer, Royal Mint, Melbourne.

Francis R. Power. Henry W. Levy.
Robert Law. *D. Avery.*
A. H. Jackson.

Ransome, Alfred Oswald,

"Beechwood," Greenock Road, Paisley.

Analytical and Works Chemist. Five years Analytical and Research Work, Oil Cloth manufacture. One and a-half years General Analytical

Research work. One year Works Chemist, Lubricating Oil Works. Two and a-half years at Works (Analytical and Research) and at Fish Oil Works (Refiners) as Head Chemist (present position).

John Stewart Remington. T. Marshall Tyson.
George Frederick Wesley Martin. Thomas Gray.
F. Henry Streatfeild.

Rees, Thomas John, B.A.(Cantab.), B.Sc.(Wales),
Cwmllynfell, Swansea Valley.

Graduate, Christ's College, Cambridge. Four years' experience in the University Laboratories, University College of Wales, Aberystwyth. Two years' experience in the University Laboratories, Cambridge. Late lecturer in Chemistry at the Technical School, Lowestoft.

H. J. H. Fenton. C. S. Gibson.
W. J. Pope. W. J. Sell.
A. E. Bellars.

Rele, Gangaram Rajendrarao,
18, Entwistle Street, Manchester.

Three years' study at the Victoria Jubilee Technical Institute, Bombay, of which I obtained the Diploma of L.T.M. Service as Sizing and Weaving Master in two of the Indian mills. Two years' study at the M.S.T., Manchester, in Applied Chemistry; obtained Certificate of the Victoria University.

Jul. Hübner. L. G. Radcliffe.
S. J. Peachey. F. S. Sinnatt.
Jas. Grant.

Ridgway, Joseph,
Rownall Hall, Wetley Rocks, Stoke-on-Trent.

Flour Miller. Cambridge Natural Sciences Tripos, Parts I and II, 1903 and 1904. Reason for desiring to become admitted: At present engaged in a manufacturing process in which Chemistry is beginning to play an active part.

J. E. Purvis. H. O. Jones.
W. J. Sell. H. J. H. Fenton.
F. W. Dootson. T. B. Wood.

Robinson, James Beglar,
Kilmarnock Dairy School.

Student. Three years' Diploma in Agriculture as awarded by Armstrong College (Durham University). The course undertaken

includes General Chemistry, particular importance being attached to Agricultural Chemistry—theoretically and practically.

P. Phillips Bedson. J. A. Smythe.
S. Hoare Collins. *R. A. Berry.*
H. H. Green.

Sen, Rajendra Nath,
41, Machnabazar Street, Calcutta, India.

Professor of Tinctorial Chemistry, Engineering College, Sibpur, Bengal, India. M.A. (Culcutta); M.Sc. (Leeds). Diploma holder in dyeing (Leeds); Silver medallist in cotton and wool dyeing (City and Guilds of London); Member of the Society of Chemical Industry; done some research work in Colour Chemistry under Prof. Green (papers to be soon published).

A. G. Green. Arthur Smithells.
J. B. Cohen. A. G. Perkin.
H. R. Procter.

Sharpe, Frederick Herbert,
The Ferns, Cressington Park, Liverpool.

Analytical Chemist. Assistant to Dr. Geo. Tate, Analyst, Liverpool, for 7 years. Assistant Teacher of Chemistry, Technical School, Liverpool, for 8 years.

George Tate. William Herbert Miles.
Thomas John Roberts. *Alfred Smetham.*
Frederick Robertson Dodd.

Smith, Percy Lancelot James,
Army College, Storrington, Sussex.

Army Tutor in Science. M.A., Oxon., Honours Chemistry. A.I.C., Branch E. (Food and Drugs). Science Master for past eleven years. 1903–1907, Chief Science Master, Blackburn Grammar School.

Alf. Chaston Chapman. A. Jaffé.
F. W. Richardson. W. W. Fisher.
Robert H. Pickard.

Smith, William James Pittock,
9, Meddowcroft Road, Gerard Road, Wallasey.

Creamery Manager. Student: connexion with Analytical Chemistry. As a student I attended a full course at the Midland Agricultural and Dairy College, Derby, and passed the Diploma Examination, which included Practical and Theoretical Chemistry and Bacteriology. I

have also passed in Chemistry in the Lancashire and Cheshire Institutes Examination.

John Golding. C. W. Walker-Tisdale.
H. D. Richmond. *John W. Tayleur.*
Fredk. J. Lloyd.

Srivastava, Jwala Prasad,
20, Curzon Avenue, Victoria Park, Manchester.

For two years a Student under Prof. H. C. Chatterji, B.A., Christ Church College, Cawnpore; for one year a student under Dr. E. G. Hill, Muir Central College, Allahabad, and for two years a student at the Municipal School of Technology, Manchester, in Applied Chemistry, where I obtained the degree of B.Sc. Tech., First Class with Honours.

Jas. Grant. Stanley J. Peachey.
F. G. Richards. F. S. Sinnatt.
E. L. Rhead.

Temperley, Claude Vareille,
Trent College.

Senior Science Master. B.Sc. (Lond.). Student, Bonn and Manchester Universities. Wishes to keep in touch with chemical progress.

H. B. Dixon. Norman Smith.
W. H. Perkin. R. Robinson.
Ch. Weizmann. *A. Lapworth.*

Terrey, Augustus George,
47, Cann Hall Road, Leytonstone, Essex.

Chemist. Assistant to Messrs. Sanitas Co., Ltd., London (Disinfectant Manufacturers). Ex-student of the Leyton Technical Institution Science Classes. Student of Chemistry under W. Robins, B.Sc., F.I.C., and at Sir John Cass Technical Institute. Am anxious to have access to the Society's publications and Library.

Charles A. Keane. W. Gordon Carey.
H. Burrows. C. T. Kingzett.
R. C. Woodcock. *F. Henry Streatfeild.*

Turner, Joseph,
Azo House, Birkby, Huddersfield.

Chemist. Director of Messrs. Read Holliday & Sons, Ltd., Aniline Colour Manufacturers, Huddersfield.

R. Meldola. J. C. Cain.
G. T. Morgan. A. G. Green.
M. O. Forster.

Turbutt, Richard Babington,

Royal Artillery Mess, Woolwich.

2nd Lieutenant in the Royal Field Artillery. Honours in Natural Science (Chemistry Branch) in the Final School of Natural Science at Oxford University. Bachelor of Arts of the same University, and desirous of learning everything new in the manufacture of explosives, steel for guns, etc.

Henry A. Miers.	N. V. Sidgwick.
H. L. Bowman.	Andrea Angel.
D. H. Nagel.	H. B. Baker.

Wallis, Robert Lauder Mackenzie,

Llwyndu, Cardiff Road, Llanishen, S. Wales.

Lecturer in Chemical Physiology, University College, Cardiff. Late Scholar, Downing College, Cambridge. Investigations: "On Chylous and Pseudo-chylous Ascites, Part I.," *Quart. Journ. Med.* (Oxford), April, 1910. "The Effects of Electric Baths on the Excretion of Creatinin in the Insane," *Journ. Ment. Science*, April, 1910. "On the Chemical Changes in Milk, and their Relation to Epidemic Diarrhœa of Infants," *Local Government Board Report* (ready for publication). "On Chylous and Pseudo-chylous Ascites, Part II.," *Quart. Journ. Med.*, Sept., 1910. B.A. (Cantab).

H. O. Jones.	Robert D. Abell.
H. J. H. Fenton.	Claude M. Thompson.
H. Jackson.	F. G. Treharne.
W. D. Halliburton.	*Charles T. Heycock.*

Williams, Arthur Bernard,

Coychurch Rectory, Bridgend, S. Wales.

Analytical Chemist and Lecturer in Chemistry. Four years' experience as Assistant in Public Analysts' Laboratories. Five years' experience as Science Master in Public and Agricultural Schools. First Class in Chemistry in Science and Art Examination, etc., etc.

Rhys P. Charles.	Clarence A. Seyler.
E. Howard Tripp.	*George Embrey.*

Herbert Eccles.

Williams, Herbert Goulding.

Robert Gordon's College, Aberdeen.

Teacher. B.Sc. (Hon.) of London University. Head of Chem. Dept. and Teacher of Advanced Classes in Chemistry in the above Institution, having Adult Evening Classes and a Secondary Day School.

T. S. Murray.	F. R. Japp.
Charles E. Browne.	*E. W. L. Foxell.*

Edmund M. Rich.

Wright, William Norman Stewart,
26, Lansdowne Crescent, Glasgow, W.

Analytical Chemist. Student under Dr. Clark, City Analyst, 138, Bath Street, Glasgow, also at the Glasgow and West of Scotland Technical College. Chemist to the British Boiler Cleaning and Enamelling Co., 201, Stobcross Street, Glasgow.

Thomas Gray. R. R. Tatlock.
G. G. Henderson. R. T. Thomson.

A. B. Steven.

Yusuf, Syed Muhammad,
Chemistry Department, School of Technology, Manchester.

Student at Municipal School of Technology, Manchester. Three years' Course in Chemistry at M. A. O. College, Aligarh (India), and two years at the Engineering College, Roorkee (India). Two years' Day Course at the School of Technology (Manchester), at the end of which obtained degree of B.Sc. Tech. in Applied Chemistry from Manchester University.

Jul. Hübner. Jas. Grant.
E. L. Rhead. F. G. Richards.
F. S. Sinnatt. S. J. Peachey.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I (3):

Cram, Marshall Perley,
Brunswick, Maine, U.S.A.

Asst. Prof. of Chemistry in Bowdoin College, and lecturer in the Maine Medical School. Received the degrees of A.B. in 1904 and A.M. in 1905 from Bowdoin College, and of Ph.D. in 1908 from the Johns Hopkins University. At present head of the department of Chemistry in Bowdoin College. Published, with J. Bishop Tingle, "Preparation of the Aniline Derivatives of Phthalic Acid and of Succinic Acid" (*Am. Chem. J.*, **37**, 596); with J. Elliott Gilpin, "The Fractionation of Crude Petroleum by Capillary Diffusion" (*U.S. G. S. Bull.*, **365**).

Ira Remsen. *W. R. Lang.*
J. Bishop Tingle. *Alexander Smith.*

Crichton, Charles,
Afrikander Mine, Klerksdorp, Transvaal.

Analytical Chemist. Four years' experience with F. Jobson, Esq., F.I.C., Sheffield; two years in charge of laboratory at Sheffield Test and Experimenting Works, and five years Chief Assayer to Klein-

fontein Group of Mines. At present Cyanide Works Manager and Assayer to the Afrikander Prop'ty Mines, Ltd., Klerksdorp.

J. K. Erskine.

Gramont, Count Arnaud de,

Rue de l'Université, 49, Paris.

Distinguished as a spectroscopist. Has contributed many memoirs to scientific journals.

William Ramsay. L. Troost.
A. Haller. Th. Schlœsing.
Armand Gautier. H. Le Chatelier.

L. de Boisbaudran.

Leechman, Alleyne,

Government Laboratory (55 Main Street), Georgetown, British Guiana.

Science Lecturer, Department of Science and Agriculture, British Guiana. Having been a Natural Science Scholar of Corpus Christi College, Oxford, and manufacturing chemist in the employ of the Australian Drug Co., Ltd., Sydney, N. S. Wales, and now holding the post of Science Lecturer, I am anxious to keep in touch with recent developments of Chemical Science.

J. B. Harrison. Jno. Williams.

E. P. Minett.

Tschugaeff, Leo,

St. Petersburg.

Professor of Chemistry at the University of St. Petersburg. The principal investigations of L. Tschugaeff concern the following questions of scientific chemistry: (1) the optical activity of organic bodies; (2) the chemistry of terpens and camphor derivatives; (3) the chemistry of cobaltammines and other complex compounds, and (4) tribolumineiscence.

Svante Arrhenius. William Ramsay.

Vance, John Fleming Culun Brown,

947, Richard St., Vancouver, B.C., Canada.

Public Analyst for the Corporation of the City of Vancouver. Appointed May 1st, 1907. Hold British Columbia Government Certificate for Efficiency in Assaying and Analytical Chemistry. Member of the Canadian Mining Institute. Chief Metallurgist to the Kamloops Mines, Ltd. (from Sept., 1904, to Sept., 1906), Kamloops, B.C.

J. O'Sullivan. J. P. Wright.

R. CLAY AND SONS, LTD., BREAD ST. HILL, E.C., AND BUNGAY SUFFOLK.

Issued 13/12/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 378.

Thursday, December 1st, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

Messrs. F. S. Long and Horace Finnemore were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Albert Ashe, Laurie Square, Romford.
Morris Cutner, B.Sc., 21, Bairstow Street, Preston.
James Edward A. Devlin, Marist Brothers College, Uitenhage, Cape Colony.
William Temple Gardner, Bruern, Alexandra Road, Upper Parkstone.
Harold James Page, Avondale, Meteor Road, Westcliff-on-Sea.
Robert Viner Stanford, M.Sc., Ph.D., Cardiff City Mental Hospital, Whitchurch, Glam.

A ballot for the election of Fellows was held, and the following were declared duly elected:

Malcolm Percival Applebey.
Manindranath Banerjee.
Fred Wilkinson Barwick.
Sarat Chandra Bhattacharya, M.A.
Stewart McGregor Bosworth, B.Sc.
André Bracher.
Frederick Hugh Rochfort Brady.
John C. Briggs.

Henry Vincent Aird Briscoe, B.Sc.
John Brown, B.Sc.
Bertram Hayward Buttle.
Frank Anthony Camp.
Frederick Challenger, B.Sc.
Reginald Thomas Colgate.
Thomas Watts Coslett.
Marshall Perley Cram, A.M., Ph.D.
David Chalmers Crawford, M.A., B.Sc.
Charles Crichton.
John Hughes Davies, B.Sc., Ph.D.
Arthur Dodd.
James Hugh Duncan.
William Gidley Emmett, B.A.
Ainslie Jackson Ensor, B.Sc.
John George Finlayson, B.A.
George Alexander Goddon.
Count Arnaud de Gramont.
Fred. Holt, B.Sc.
Prince Mahmood Ali Khan, B.A.
Edmund Knecht, M.Sc., Ph.D.
William Arthur Knight, M.A.
Bertram Lambert, M.A.
Alleyne Leechman.
Kenneth Stewart Low.
Clement Ward Lowe.
David Jackson MacGeorge.
Malcolm McNish.
Rikō Majima.
James Irvine Orme Masson, M.Sc.
Thomas R. Merton, B.Sc.
Alec Duncan Mitchell, B.Sc.
Dhirendranath Mitra, B.A.
Harold Moore, B.Sc.
James Eckersley Myers, B.Sc.
Valliyil Govindan Nair, B.A., B.Sc.
Sidney Herbert Newman, B.Sc.
John Hamilton Paterson, M.Sc.
Alfred John Pennington.
Benjamin Ashwell Posford.
Hari Prasad, B.A.
Frederick Valentine Ramsden.
Alfred Oswald Ransome.
Thomas John Rees, B.A., B.Sc.
Gangaram Rajendrarao Rele.
Joseph Ridgway, B.A.
James Beglar Robinson.
Rajendra Nath Sen, M.A., M.Sc.
Frederick Herbert Sharpe.
Percy Lancelot James Smith, M.A.
William James Pittock Smith.
Jwala Prasad Srivastava, B.Sc.
Claude Vareille Temperley, B.Sc.
Augustus George Terrey.
Leo Tschugaeff.
Richard Babington Turbutt, B.A.
Joseph Turner.
John Fleming Culun Brown Vance.
Robert Lauder Mackenzie Wallis, B.A.
Arthur Bernard Williams.
Herbert Goulding Williams, B.Sc.
William Norman Stewart Wright.
Syed Muhammad Yusuf, B.Sc.

Of the following papers, those marked * were read:

***321. "The triazo-group. Part XV. Triazoethylene (vinylazoimide) and the triazoethyl halides." By Martin Onslow Forster and Sidney Herbert Newman.**

Triazoethylene (*vinylazoimide*), $CH_2{:}CHN_3$, prepared by the action of hot alcoholic potassium hydroxide on triazoethyl bromide or iodide, is a pale yellow liquid, boiling at 26°/760 mm. The dibromide is rapidly decomposed by cold water, yielding bromoacetaldehyde with hydrazoic and hydrobromic acids.

β-Chloro-α-triazoethane (*triazoethyl chloride*), $N_3{\cdot}CH_2{\cdot}CH_2Cl$, obtained from triazoethyl iodide by heating it with mercuric chloride, boils at 45°/25 mm., and has D^{24} 1·2885. *β-Bromo-α-triazoethane* (*triazoethyl bromide*), $N_3{\cdot}CH_2{\cdot}CH_2Br$, arising from triazoethyl alcohol and phosphorus tribromide, boils at 49°/20 mm.,

and has D^{19} 1·6675. *β-Iodo-α-triazoethane* (*triazoethyl iodide*), $N_3 \cdot CH_2 \cdot CH_2I$, produced when a solution of sodium iodide in dry acetone acts on the foregoing substance, boils at 68°/20 mm., and has D^{25} 1·9154.

β-Triazoethyl ether, $N_3 \cdot CH_2 \cdot CH_2 \cdot O \cdot C_2H_5$, is the result of heating triazoethyl alcohol with ethyl iodide and dry silver oxide; it boils at 49°/25 mm., and has D^{24} 0·9744.

Discussion.

The President asked Dr. Forster whether he had attempted to heat the vapour of triazoethylene, and, if so, whether it had exploded.

Dr. T. Callan inquired whether the authors had tried the action of silver azide on triazoethyl iodide with a view to obtaining, by simple replacement of the iodine by the triazo-group, a compound with two triazo-groups in the molecule.

Dr. Forster stated that the vapour of triazoethylene had not been heated; nor had any attempt been made to effect interaction between triazoethyl iodide and silver azide, because the symmetrical bistriazoethane which should arise could be prepared by a more simple process, and had already been examined.

*322. "The dinitro-derivatives of dimethyl-*p*-toluidine." By Gilbert T. Morgan and Arthur Clayton.

Although dimethyl-*p*-toluidine, when nitrated in concentrated sulphuric acid solution, yields only 2-nitrodimethyl-*p*-toluidine, yet when the nitration mixture is poured into water so that the temperation rises to 40°, the reaction proceeds a stage further, and 2 : 5-dinitrodimethyl-*p*-toluidine (m. p. 103—104°) is produced. The position assumed by the second nitro-group in this compound was ascertained in the following manner.

2-Nitrodimethyl-*p*-toluidine, when reduced and acetylated, yielded 2-acetyl-4 : 4-dimethyl-2 : 4-diaminotoluene, which, on nitration, gave 5-*nitro*-2-*acetylaminodimethyl*-p-*toluidine*. On reduction, this nitro-compound furnished 2-*acetyl*-2 : 5-*diaminodimethyl*-p-*toluidine*, which, by the agency of the Sandmeyer reaction, gave rise to 5-bromo-2-acetylaminodimethyl-*p*-toluidine, the constitution of which has already been determined.

The foregoing 2-acetyl-2 : 5-diaminodimethyl-*p*-toluidine was converted into 2 : 5-diacetyldiaminodimethyl-*p*-toluidine, which can also be prepared by reducing 2 : 5-dinitrodimethyl-*p*-toluidine and acetylating the resulting 2 : 5-diaminodimethyl-*p*-toluidine, thus

demonstrating the position of the second nitro-group in 2 : 5-dinitrodimethyl-*p*-toluidine. 2 : 6-*Dinitrodimethyl*-p-*toluidine* (m. p. 192°), was prepared by the action of methyl sulphate on 2 : 6-dinitro-*p*-toluidine.

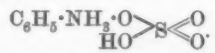
Discussion.

Dr. Flürscheim mentioned that Crum Brown and Gibson's rule, which did not profess to explain the directing influences in the benzene nucleus, had also ceased to correspond with facts (compare *J. pr. Chem.*, 1902, [ii], **66**, 322). He had also proved that the alternate hypothesis advocated by Dr. Morgan—the prevention of ortho-para-substitution by the negativity of a substituent—also did not agree with facts (compare *J. pr. Chem.*, 1902, [ii], **66**, 329; 1905, [ii], **71**, 500).

On the other hand, he had himself suggested a solution based on the varying strength of "single" bonds (compare *loc. cit.*, and *J. pr. Chem.*, 1907, [ii], **76**, 197, for directing influence of methyl; also *Ber.*, 1906, **39**, 2015), and this had been borne out by every observed fact. The sole exception had hitherto been Dr. Morgan's suggestion (*Proc.*, 1910, **25**, 82) that, in dilute acid, a second nitro-group entered 2-nitrodimethyl-*p*-toluidine and possibly in the 6-position. The experimental decision had been left to him and Mr. Clayton, and their results had vindicated his (the speaker's) theory.

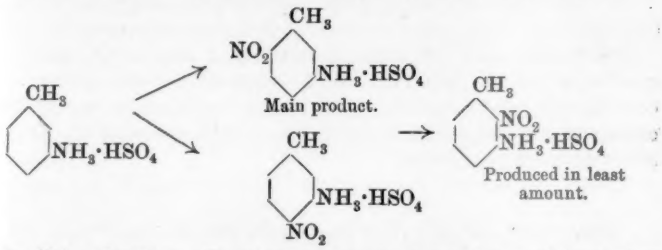
Dr. Morgan, in reply, said that they regarded the nitration phenomenon from a mechanical standpoint, based on the Pope and Barlow theory of the configuration of benzene, whereas Dr. Flürscheim, in looking at the matter rather from the point of view of Kekulé's benzene formula, laid too much stress on the connexion between unsaturation of the substituent radicle and its power of inducing ortho-para-substitution. But although the unsaturated groups, NH_2, OH, etc., induced substitution in the ortho-para-positions, yet the methyl radicle did the same, and the latter group could not fairly be assumed to possess much residual affinity.

On the other hand, he regarded the groups, $-NH_3 \cdot HSO_4$, $-NH_2R \cdot HSO_4$, and $-NHR_2 \cdot HSO_4$, present when aromatic amines were nitrated in concentrated sulphuric acid, as being distinctly unsaturated complexes owing to the presence of double linkings in the sulphate group:



Nevertheless, these complexes did not usually induce substitution in ortho-para-positions, but in meta-positions. Where the latter positions were not assumed, as in the case of *m*-toluidine, the

exceptional orientation could be traced to the influence of other substituents (Noelting and Stoecklin, *Ber.*, 1891, **24**, 564):



In this nitration, the nitro-groups took up the positions they would assume even in the absence of the $NH_3 \cdot HSO_4$ radicle, this result indicating that the directive (attractive) influence of the saturated methyl group prevailed over the influence of the sulphate complex, the repulsive effect of which was observed only in the fact that 6-nitro-*m*-toluidine was the chief product.

***323. "Experiments on the Walden inversion. Part VI. Conversion of the optically active α-hydroxy-α-phenylpropionic acids into α-chloro-α-phenylpropionic acids." By Alex. McKenzie and George William Clough.**

The authors find that thionyl chloride and phosphorus pentachloride behave differently towards *l*-α-hydroxy-α-phenylpropionic acid, inasmuch as the former gives *l*-α-chloro-α-phenylpropionic acid, whereas the latter gives *d*-α-chloro-α-phenylpropionic acid. The action of thionyl chloride and of phosphorus pentachloride on optically active ethyl α-hydroxy-α-phenylpropionate has also been examined.

324. "The auto-reduction of hydrazines." By Frederick Daniel Chattaway and Montague Aldridge.

Aromatic hydrazines, when heated, undergo simultaneous oxidation and reduction, whereby an amine, ammonia, nitrogen, and a hydrocarbon are produced, according to the equation: $2R \cdot NH \cdot NH_2 = RNH_2 + NH_3 + N_2 + RH$.

The reaction is a general one, and, in the case of unsubstituted primary hydrazines, such as phenylhydrazine, the tolylhydrazines, and the naphthylhydrazines, takes place quantitatively. It proceeds slowly even at the boiling temperature, the rate increasing rapidly as the boiling point of the hydrazine is approached. It is

thus impossible to obtain any hydrazine in a state of purity by distillation.

The slow decomposition which hydrazines undergo on keeping, even when air is excluded, is due to this auto-reduction.

In the case of hydrazines containing a substituted aromatic residue, although this primary decomposition takes place to a considerable extent, other reactions may also occur on heating, especially at a high temperature, due to the presence of the substituting atoms or groups.

325. "The activity of acids as catalysts in relation to the nature of the solvent medium." By Harry Medforth Dawson.

The influence of the nature of the solvent on the rate of the tautomeric change of acetone, in presence of sulphuric acid as a catalyst, has been investigated in alcohol–water mixtures ranging from pure water to anhydrous alcohol. It is found that the velocity of the tautomeric change is nearly independent of the composition of the solvent if this contains less than about seventy volumes per cent. of ethyl alcohol. As the proportion of alcohol is increased, the reaction velocity increases, slowly at first, but afterwards more and more rapidly, until in anhydrous alcohol the speed is more than one hundred times as great as it is in aqueous solution. The large changes in velocity are probably due to changes in the catalytic activity of the acid in the different solvents. Although the velocities in alcohol and in water differ to such a very large extent, the concentrations of the positive acid ions in equimolar acid solutions appear to be very nearly equal, and it is supposed that the actual catalyst is represented by free hydrogen ions, which, however, in consequence of their relatively small concentration, play only a subsidiary part in connexion with the electrical conductivity of the solutions.

326. "The volume of a solute in solution." By Dan Tyrer.

The volume changes which occur on the dissolution of a solute have been measured, and the specific solution volume of the solute has been calculated by means of the equation:

$$v = \frac{(100 + A)S_1 - 100S_0}{A},$$

where v is the specific solution volume, or the change in volume caused by the dissolution of 1 gram of the solute, A the percentage concentration of the solution, S_1 the specific volume of the solution, and S_0 that of the pure solvent. The values of S_1 and the values

of v, calculated according to the above equation, have been determined for a large number of solutions of various solutes and solvents by means of the dilatometer and pyknometer.

Normal organic solutes and solvents have been used to avoid complications through molecular association or dissociation. It has been found that (1) the specific solution volume is, in most cases, constant and quite independent of the concentration, (2) the specific solution volume of the solute varies but slightly from solvent to solvent.

The cause of the variations with change of solvent was discussed, and the hypothesis was put forward that through an increase or decrease in the molecular attraction between the molecules of solvent and solute, a contraction or expansion of the solvent occurs, causing a variation in the calculated specific volume of the solute in solution.

327. "The absorption spectra of some derivatives and isomerides of 1 : 2-diketo-Δ^3-*cyclo*pentene." By John Edward Purvis.

The results of this investigation show that (1) the colour is determined primarily by the monoketonic and diketonic structures; (2) the absorption in the more refrangible regions of the monoketonic compounds is determined by the type of ring in which the ketonic structure occurs; (3) in the diketonic compounds the colour is modified in the direction of the more refrangible regions by the introduction of an oximino- or :N·NHPh group, a result analogous to that previously observed in diketopyrrolines; (4) in the diketonic compounds the absorption of the phenylhydrazone or of the *iso*phenazine derivative is wholly different from that of the corresponding substances derived from the diketopyrrolines; (5) the difference in the *iso*phenazine compound and in a bluish-coloured sodium derivative of 1 : 2-diketo-Δ^3-*cyclo*pentene is explained as the result of changes in the positional valencies of the ring.

328. "4-β-Aminoethylglyoxaline (β-iminazolylethylamine) and the other active principles of ergot." By George Barger and Henry Hallett Dale.

The identification of an ergot base having a very powerful action on the isolated uterus as 4-β-aminoethylglyoxaline (β-iminazolylethylamine) (this vol., p. 128) has been completed by analysis of the dipicrate, and by a comparison of physiological properties. The method of isolation was described in detail.

329. "Synthesis of camphoric acid." By Gustav Komppa.

Although Thorpe (*Proc.*, 1909, **25**, 94) was able to obtain only a 10 per cent. yield of methyl diketo*apo*camphorate, three of the author's assistants have obtained yields varying from 45 to 70·5 per cent.

From the methylated ester, which Blanc and Thorpe (*Trans.*, 1910, **97**, 836) state to be the *O*-methyl ether, the author has now prepared, for the fifth time, *r*-dehydrocamphoric acid, and from this has obtained *r*-camphoric acid.

The author maintains the constitution previously assigned by him to methyl diketocamphorate, and shows that the methyl group in question must be attached to carbon and not to oxygen, as boiling hydriodic acid (Zeisel) fails to remove it.

330. "Viscosity and association. Part I. Association of the phenols." By Ferdinand Bernard Thole.

The viscosities of a number of phenols and their derivatives have been measured both in the pure state and in solution. From the results, the following conclusions have been drawn:

(1) The results obtained by the viscometric method agree very closely with those derived from other physical constants, such as vapour pressure, dielectric constant, molecular surface energy, molecular refractivity, and molecular weight determined cryoscopically.

(2) The viscosity determinations, using $\frac{\eta}{\text{mol. vol.}} \times 10^6$ as a criterion of association, show that phenols are associated, the ortho-compounds to the least, and the para-compounds to the greatest, extent. The ethers are not associated, but the acetates show slight association.

(3) The carbethoxyl, aldehyde, nitro- and halogen groups exert a marked inhibitive influence on association. Alkyl groups exert only a slight influence. Since the degree of inhibition of association appears to be intimately connected with the degree of unsaturation of the substituent, it is suggested that the depression of association is partly due to an attraction between the latent valency of the hydroxylic oxygen and the unsaturated substituent, the consequence being a diminution of the tendency to form complexes through the latent valency of the hydroxyl group. The same hypothesis explains the gradual disappearance of the characteristic reactivity of the carbonyl group in the series acetone–ethyl acetate–acetic acid.

(4) Solution in even a comparatively non-dissociating solvent, such as amyl acetate, produces considerable disruption of the molecular aggregates. In a dissociating solvent, such as ethyl alcohol, the dissociation is practically complete.

331. **"Compounds produced by the simultaneous action of nitrites and hyposulphites on nickel salts. A method for the detection of nickel in presence of much cobalt." (Preliminary note.) By Walter Craven Ball.**

When solutions of sodium or potassium nitrite and nickel nitrate are mixed, and sodium hyposulphite is gradually added, the liquid assumes the colour of a permanganate solution, and needle-shaped, dark purple crystals separate. This substance, of which the formula is possibly $Na_3NiNS_2O_8,4H_2O$, seems to be the sodium salt of a complex acid containing nickel. The potassium salt, similar in colour, but more soluble, may be obtained by a slight modification of the method. Both salts yield purple precipitates with barium and strontium solutions. Similar complex cyanides, of an intense reddish-purple colour, may be obtained by treatment of the above substances with potassium cyanide, and also by the oxidation of ammoniacal solutions of hydroxylamine, containing a nickel salt and a cyanide. They are soluble in alcohol and other organic solvents, and afford a ready means of detecting nickel in presence of much cobalt.

The compounds are all very unstable, and from their method of preparation would appear to be derived from some compound intermediate between nitrous acid and hydroxylamine, possibly from dihydroxylamine.

ADDITIONS TO THE LIBRARY.

I. *Donation.*

Fenton, *Henry John Horstman.* Outlines of chemistry. With practical work. Part I. 2nd edition. pp. xviii + 415. Cambridge 1910. (*Recd.* 5/12/10.) From the Author.

II. *By Purchase.*

Buchner, *Georg.* Die Metallfärbung und deren Ausführung mit besonderer Berücksichtigung der chemischen Metallfärbung. 4th edition. pp. xvi + 397. Berlin 1910. (*Recd.* 28/11/10.)

Koerner, *Wilhelm.* Ueber die Bestimmung des chemischen Ortes bei den aromatischen Substanzen. Translated and edited by *G.* **Bruni**

and *B. L.* **Vanzetti.** (Ostwald's *Klassiker*, No. 174.) Leipzig 1910. (*Recd.* 10/12/10.)

Lomonossow, *M. W.* Physikalisch-chemische Abhandlungen, 1741–1752. Edited by *B. N.* **Menschutkin** and *Max* **Speter.** (Ostwald's *Klassiker*, No. 178.) Leipzig 1910. (*Recd.* 10/12/10.)

Rechenberg, *C. von.* Theorie der Gewinnung und Trennung der Aetherischen Oele durch Destillation. pp. xii + 259 to 751. [Supplement to **Gildemeister,** *E.*, and **Hoffman,** *Fr.*, "Die aetherischen Oele."] Leipzig 1910. (*Recd.* 28/11/10.)

Woker, *Gertrud.* Die Katalyse. Die Rolle der Katalyse in der analytischen Chemie. I. Allgemeiner Teil. (Die chemische Analyse, Vol. XI and XII.) Stuttgart 1910. (*Recd.* 9/12/10.)

III. *Pamphlets.*

Siegrist, *H.* De la constitution de quelques dérivés iodés. (From the *J. Suisse Chim. Pharm.*, 1910, **48.**)

Studzinski, *J.* Ueber die giftigen Eigenschaften des Blutes. (From the *Zentr. Physiol.*, 1910, **23.**)

Tassilly, *E.* L'essence d' Ylang-Ylang de la Réunion. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

Thunberg, *Torsten.* Studien über die Beeinflussung des Gasaustausches des überlebenden Froschmuskels durch verschiedene Stoffe. (From the *Skand. Arch. Physiol.*, 1909, **23.**)

Thunberg, *T.* Ueber katalytische Beschleunigung der Sauerstoffaufnahme der Muskelsubstanz. (From the *Zentr. Physiol.*, 1910, **23.**)

Waidner, *C. W.*, and **Burgess,** *G. K.* Note on the temperature scale between 100° and 500° C. (From the *Bull. Bureau of Standards*, 1910, **7.**)

Walter, *E.* Ueber die Verwendung des Benzidins für den Blutnachweis, im besonderen über seine Anwendungsweise in der gerichtsärztlichen Praxis. (From the *Deut. Med. Woch.*, 1910.)

Walpole, *George Stanley.* A method of titrating physiological fluids. (From the *Proc. Physiol. Soc.*, 1910; *J. Physiol.*, **40.**)

Wielen, *P. Van der.* Dosage de la morphine, de la narcotine et de la codéine dans l'opium et dans les préparations galéniques de l'opium. (From the *Bull. Sci. Pharm.*, 1910, **17.**)

ERRATUM.

PROCEEDINGS, 1910.

Page	Line	
268	20	*for* "ethyl" *read* "othyle."

At the next Ordinary Scientific Meeting on **Thursday**, December 15th, 1910, at **8.30** p.m., the following papers will be communicated:

"Studies on enzyme action. Part XV. The comparative influence of monohydric C_nH_{2n+1} alcohols and other non-electrolytes on enzymic activity." By H. E. Armstrong and E. F. Armstrong.

"Studies on enzyme action. Part XVI. The enzymes of emulsin (II). Prunase." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XVII. The enzymes of emulsin (III). The probable seat of origin of amygdalin." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XVIII. Enzymes of the emulsin type (II). The distribution of β-glucases in plants." By H. E. Armstrong, E. F. Armstrong, and E. Horton.

"Studies on enzyme action. Part XIX. Enzymes of the emulsin type (III). Linase." By H. E. Armstrong and J. V. Eyre.

"The interaction of alloxan and glycine." By W. H. Hurtley and W. O. Wootton.

"Traube's molecular-volume method applied to binary mixtures of organic substances." By W. R. G. Atkins.

"Investigations on the dependence of rotatory power on chemical constitution. Part I. The rotations of the simplest secondary alcohols of the fatty series. By R. H. Pickard and J. Kenyon.

"Oxycodeine. A new alkaloid from opium." By J. J. Dobbie and A. Lauder.

"Studies in the carbazole series." By C. Schwalbe and S. Wolff.

"Syntheses with phenol derivatives containing a mobile nitro-group. Part III. Complex iminazoles, azo-compounds, and azides." By R. Meldola and H. Kuntzen.

"The chemistry of mesothorium." By F. Soddy.

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Issued 30/12/10

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 26. No. 379.

Thursday, December 15th, 1910, at 8.30 p.m., Professor HAROLD B. DIXON, M.A., Ph.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society in the death of Prof. Dr. Rudolph Fittig on November 19th, and stated that the following telegram of condolence had been forwarded to Herr Fittig:

"The President, Officers, and Council of the Chemical Society deeply mourn the loss of their distinguished Honorary and Foreign Member, Professor Dr. Rudolph Fittig.—HORACE T. BROWN, Foreign Secretary."

It was announced that the Faraday Lecture would be delivered by Professor Theodore W. Richards on June 14th, 1911.

Messrs. H. V. A. Briscoe, H. Leslie F. Buswell, Rikō Majima, A. D. Mitchell, and Sidney H. Newman were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

James Allan, M.A., B.Sc., Ravenscourt, Lerwick, Shetland Isles.
Joseph Bate, 59, Southwood Lane, Highgate, N.
Joseph Mayson Blackburn, 346, Deane Church Lane, Bolton.
Michael Angelo Fielding, 8, St. Joseph's Place, Cork.

Evan Dalton Griffiths, B.Sc., 9, Wanstead Park Avenue, Manor Park, E.

Arthur Bennett Hall, 31, Dyer Street, Kirkham.

Charles Herbert Hampshire, B.Sc., 19, Brook Street, Ilkley.

Bernard Grindrod Hough, The Chestnuts, Wardle Road, Sale.

Ernyst Graham Laws, B.A., Alverna, Edith Road, Ramsgate.

Ian Gordon Sellar Wink, 27, Panmuir Road, Cottenham Park, Wimbledon, S.W.

Of the following papers, those marked * were read:

*332. **"Studies on enzyme action. Part XV. The comparative influence of monohydric (C_nH_{2n+1}) alcohols and other non-electrolytes on enzymic activity." By Henry E. Armstrong and Edward Frankland Armstrong.**

The influence exercised by a number of non-electrolytes in several cases of enzymic change was considered from the point of view of the influence of molecular weight in modifying activity in the case of related compounds.

*333. **"Studies on enzyme action. Part XVI. Prunase and amygdalase: their separate occurrence in plants." By Henry E. Armstrong, Edward Frankland Armstrong, and Edward Horton.**

It has been argued in former communications that the hydrolysis of amygdalin by almond emulsin is effected in several stages by distinct enzymes, the contention being that it is first resolved into a molecule of glucose and Fischer's glucoside by the action of amygdalase, Fischer's glucoside being then resolved into glucose and mandelonitrile by the agency of a second enzyme. Sources of the latter enzyme, in which it is unaccompanied by amygdalase, were indicated.

Evidence was adduced from which it was inferred that amygdalin is usually formed in the fruit, probably from Fischer's glucoside formed in the leaves.

*334. **Studies on enzyme action. Part XVII. The distribution of β-glucases in plants." By Henry E. Armstrong, Edward Frankland Armstrong, and Edward Horton.**

A general method of studying the enzymes in plants was described and examples were given of its application.

***335. "Studies on enzyme action. Part XVIII. Linase." By Henry E. Armstrong and John Vargas Eyre.**

Further examples were given of the application of the method described in Part XVII to more than a dozen species of *Linum*; the experiments have been carried out with the object of studying the enzyme characteristic of this family.

DISCUSSION.

Dr. RUSSELL pointed out that some of the leguminous plants mentioned by Professor Armstrong as being rich in glucoside-splitting enzymes were also known to undergo very rapid fermentation in the animal stomach, which seemed to indicate high enzymic activity in other directions also. He further asked what was the function of the hydrolytic products of the glucosides, and whether it was possible that some of them might act in the plant in the same way as hormones acted in the animal, by controlling certain of the processes going on. When, for example, the reproductive processes began in the plant there set in an alteration in the type of changes taking place, vegetative growth giving place to seed formation. The mechanism bringing about this alteration in the case of animals could hardly be assumed in the case of plants, but it was conceivable that some of the bodies Professor Armstrong had described might be effective.

In answer to Mr. Hall, Professor ARMSTRONG said that the amount of enzyme present in the organs of a plant was undoubtedly different at different seasons, and it would be necessary to study plants over the whole period of growth.

In answer to Dr. Russell, he said that they had been led to conclude that glucosides were not so much reserve food materials in the ordinary sense of the term, or protective agents, but that, in many cases, the significant constituent exercised a function in the plant similar to that which it exercised when present in human food—that is to say, they served to stimulate enzymic change. It was an interesting fact that seeds of plants rich in glucoside often germinated with extreme readiness, the plant also growing rapidly, as in the case of mustard, for example. The change involved in the ripening of seeds might well be hastened by the rapid separation of hydrogen cyanide, for example, from a cyanophoric glucoside towards the close of the period of growth. The final disappearance of the cyanide from linseed and from vetch seeds was perhaps to be explained in this way. In the case of the banana, the unripe green pod blackened rapidly under the influence of anæsthetics; in the natural ripening process, this change was determined from

within the fruit by the liberation of a fruit ether (ethereal salt), and the outward blackening was thus a signal of the completion of inward change.

***336. "Investigations on the dependence of rotatory power on chemical constitution. Part I. The rotations of the simplest secondary alcohols of the fatty series." By Robert Howson Pickard and Joseph Kenyon.**

The resolution of the inactive forms and determinations of the rotatory powers at different temperatures and other properties of the optically active forms of the following alcohols were described: methylethylcarbinol, methyl-*n*-propyl-, methyl-*n*-butyl-, methyl-*n*-amyl-, methyl-*n*-hexyl-, methyl-*n*-heptyl-, methyl-*n*-octyl-, methyl-*n*-nonyl-, methyl-*n*-decyl-, methyl-*n*-undecyl-, ethyl-*n*-hexyl-, methyl*iso*butyl-, phenylmethyl-, and phenylethyl-carbinols.

***337. "The chemistry of mesothorium." By Frederick Soddy.**

Experiments on the mixture of radium and mesothorium with barium sulphate, obtained by adding a barium salt and sulphuric acid to a solution of thorianite in nitric acid, have shown that the separation of mesothorium is not due, as previously has been supposed, to its adsorption by the barium sulphate, but depends on a true chemical analogy between mesothorium and barium of the same kind as exists between barium and radium. The mesothorium could not be concentrated from the barium by chemical methods. By fractional crystallisation of the chlorides, the mesothorium remains with the radium, and can thus be separated from the barium. The proportion between mesothorium and radium is completely unchanged by fractional crystallisation of the chlorides. In the ordinary method used in the manufacture of thorium compounds for dissolving monazite sand, by heating it with excess of sulphuric acid and agitating the product with water, some of the mesothorium remains in the insoluble residue, but the greater part passes into solution. If a small quantity of a barium compound is mixed with the monazite sand before treatment, practically the whole of the mesothorium is separated with the insoluble residue, none passing into the solution. The part of the residue containing the mesothorium can readily be separated from the heavy unattacked sand by decantation. From this part the mesothorium can be separated by methods similar to those employed in the working up of pitchblende residues for radium. The cases of complete chemical identity between groups of radioactive elements, differing presumably in

atomic weight, which now appear to include all the radioactive elements of period of average life longer than a year, are in direct conflict with the principle of the periodic law.

338. "Traube's molecular volume method applied to binary mixtures of organic substances." By William Ringrose Gelston Atkins.

The compounds and eutectic mixtures described by Philip (*Trans.*, 1903, **83**, 814) were prepared and their densities determined at or slightly above their melting or eutectic points respectively. Chloral hydrate was also studied.

In dealing with a compound, the molecular weight is given according to Traube by: $M' = \rho(\Sigma$ atomic volumes + co-volume), whereas if the calculation of the sum of the molecular weights of the molecules in the material being studied be made, one obtains: $M = \rho(\Sigma$ atomic volumes + n co-volumes), where n is the number of molecules going to form the supposed compound. From the measure of agreement between the values thus obtained and the theoretical molecular weight of the assumed compound, it is possible to ascertain whether a compound exists or whether the fused mass is merely a mixture, eutectic or otherwise.

Below are given the calculated molecular weights obtained from the relation:

$$M = \rho_t[\Sigma \text{ at. vol. } + \text{ co.-vol. at } 0^\circ (1 + \alpha t)]$$

for a compound, and

$$M = \rho_t[\Sigma \text{ at. vol. } + n \text{ co.-vol. at } 0^\circ (1 + \alpha t)],$$

using the values for the constants given by Reychler (*Outlines of Physical Chemistry*, p. 68) and by Smiles (*Chemical Constitution and Some Physical Properties*, p. 143), where α is the coefficient of expansion of a gas.

	ρ.	M (as compd.).	M (as mixture).	M (theoretical).
(1) *o*-Nitrophenol and *p*-toluidine	$\rho_{16/15} = 1{\cdot}171$	221	251	246

Freezing-point curve shows eutectic point at 15·6°. Traube's method reveals, at the most, slight association.

(2) Phenol and α-naphthylamine	$\rho_{29/15} = 1{\cdot}125$	223	253	237

Both methods point to a considerably dissociated compound, m. p. 28·8°.

(3) Phenol and *p*-toluidine	$\rho_{30/15} = 1{\cdot}037$	186	214	201

Both methods show a considerably dissociated compound, m. p. 28·5° or 30·0°, according to which crystalline form was present.

(4) Phenol and diphenylamine	$\rho_{38/15} = 1{\cdot}075$	266	294	263

Freezing-point curve shows eutectic point at 18·1°. Traube's method points to the opposite conclusion.

(5) Phenol (2 mols.) and carbamide (1 mol.)	$\rho_{61/15}=1·104$	216	264	244

Both methods point to a considerably dissociated compound, m. p. 61°.

(6) Aniline and *p*-cresol	$\rho_{24/15}=1·032$	185	212	201

Both methods show a greatly dissociated compound.

(7) *p*-Toluidine and α-naphthol	$\rho_{54/15}=1·075$	229	260	251

A highly dissociated compound is shown by the freezing-point curve. Traube's method agrees with this, but the results might almost equally well be taken as pointing to slight association among the like molecules.

(8) Chloral hydrate	$\rho_{66/4}=1·575$	163·5	216·6	165·5

The magnetic rotation and chemical evidence point to a compound, as does the above calculation.

(9) Ammonium thiocyanate (3 mols.) and thiocarbamide (1 mol.)	$\rho_{105/15}=1·231$	298	423	304

Findlay's determinations of the freezing-point curves show that this is a mixture. Traube's method indicates a compound.

Thus in seven of the examples the evidence afforded by the various methods is not contradictory, whilst in two cases the results are absolutely at variance. It must, however, be remembered that the values obtained by Traube's method indicate association in the fused mass without distinguishing, for example, whether in No. 2 it is the phenol molecules which are associated with each other and the α-naphthylamine similarly, or whether the phenol and α-naphthylamine molecules combine in a certain percentage of cases. If, however, the latter be the case, it is not easy to see why the association of the phenol should be between one and two when mixed with α-naphthylamine, and between two and three when mixed with carbamide. For the latter conclusion cannot be avoided unless it is supposed that the association of the carbamide in phenol solution is sufficiently high to raise the average of the mixture (phenol, 66 per cent., carbamide, 33 per cent., by molecules) to the value found. This is rendered very unlikely, as a determination of the molecular weight of thiocarbamide in phenol (about 1·7 per cent. of thiocarbamide by weight) gave a nearly normal value, 87 instead of the theoretical 76. This result was obtained in an attempt to trace the freezing-point curve of phenol and thiocarbamide to see if a compound similar to the phenol–carbamide compound could be obtained. However, the separation of crystals of what had all the appearance of being thiocarbamide show an

eutectic point at 36·8°, only 3·74° below the melting point of the pure phenol used. The thiocarbamide present at the eutectic point amounted to only 4·2 per cent.

Thus it seems fair to conclude that whilst by Traube's method alone it is not possible to decide whether the association is between the like molecules or the unlike, taking other facts into consideration the method may be considered trustworthy for temperatures up to 60° at any rate. Above this the effect of the coefficient α becomes considerable. In view, however, of the very good agreement in the case of chloral hydrate (163·5 calc., and 165·5 theoretical) at 66°, it seems to be quite allowable to use the method at 105° for the thiocarbamide–thiocyanate fused mass. The above evidence for the existence of Philip's compounds in the liquid state receives confirmation from Treitschke's viscosity measurements (*Zeitsch. physikal. Chem.*, 1907, **58**, 425). These show that the compounds exist as such, but in a largely dissociated condition. Rise of temperature increases the dissociation.

339. "Hydroxycodeine: a new alkaloid from opium." By James Johnston Dobbie and Alexander Lauder.

This alkaloid was discovered by Messrs. T. and H. Smith, Edinburgh, in the mother liquors obtained in the working up of the opium alkaloids after the ordinary alkaloids have been eliminated. It has the formula $C_{18}H_{21}O_4N$, and is a tertiary base. It is soluble in water and the usual organic solvents. So far it has not been obtained in the crystalline condition. On heating, it softens about 40°, and is completely melted at 51°. It is slightly dextrorotatory, and contains one methoxyl group. The *hydrobromide*, $C_{18}H_{21}O_4N,HBr$, crystallises readily from water in large, hard, prismatic crystals. The *platinichloride* has the formula $(C_{18}H_{21}O_4N)_2,H_2PtCl_6$.

The alkaloid appears to be a hydroxy-derivative of codeine; its absorption spectra agree very closely with those of codeine, and the colour reactions of the two alkaloids are practically identical.

340. "Studies in the carbazole series." By Carl Gustav Schwalbe and Salomon Wolff.

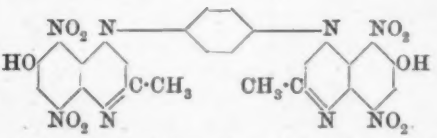
The object of this work was to prepare mercaptans of carbazole with the view of converting them into sulphide dyes and sulphonic acids. It was found that in most cases, instead of the required mercaptan being obtained, the derivatives employed were reconverted into carbazole itself. In repeating the preparation of

carbazoledisulphonic acid according to Schultz and Hauenstein's method (*J. pr. Chem.*, 1886, [ii], **33**, 1907), the authors obtained a disulphonic acid having different properties, giving, for example, a different disulphonyl chloride and disulphonamide. In sulphonating carbazole under various conditions, a monosulphonic acid was never obtained, but disulphonic acids or a mixture of di- and tri-sulphonic acids always resulted. Carbazole is easily sulphonated by 67 per cent. sulphuric acid, giving a disulphonic acid, differing from that of Schultz and Hauenstein, and also from the acid mentioned above. On sulphonating 3-nitrocarbazole and subsequent reduction, an amino-disulphonic acid was isolated.

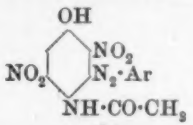
1-*Phenyl*-1 : 2 : 3-*benzotriazole*-5-*sulphonic acid* was prepared by the diazotisation of *o*-aminodiphenylamine-*p*-sulphonic acid. This triazole, on heating, gave carbazole instead of the expected monosulphonic acid.

341. "Syntheses with phenol derivatives containing a mobile nitro-group. Part III. Complex iminazoles, azo-compounds, and azides." By Raphael Meldola and Harold Kuntzen.

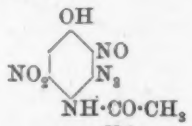
The authors indicated the existence of a new type of bisiminazoles, and described the first member of this series, which is a colloidal substance of the formula:



A further study of the interaction of trinitroacetylaminophenol and aromatic hydrazines has led to the discovery that asymmetric secondary hydrazines are without action, but that primary hydrazines yield azo-compounds of the type (I):



(I.)



(II.)

It was also shown that the trinitro-compound is readily decomposed by sodium azide with the formation of the triazo-compound (II).

342. "The correlation of viscosity with other constitutive properties." (Preliminary note.) By Thomas Percy Hilditch and Albert Ernest Dunstan.

The authors have been engaged for some time on an investigation concerning the effects of various constitutive features on the viscosity coefficient in an attempt to bring this property into line with molecular refraction, dispersion, magnetic rotatory power, optical rotatory power, and the like. They have found that in general a close parallelism exists between the effects of unsaturation (simple and conjugated) on these diverse properties.

In particular, the result of acetylenic union is invariably to raise the viscosity coefficient, whilst a similar observation was made in general for the ethylenic linking. On the other hand, the saturated compounds in all cases have the lower viscosity, and in most a noticeably greater molecular volume. Various cases of conjugated unsaturation also have been examined, and the authors have found a remarkable exaltation in comparison with the values obtained from unconjugated unsaturated substances.

Symmetrically conjugated compounds have been found to exhibit a still more extraordinary anomaly. As an illustration may be quoted the times of efflux for the following typical cases:

4-Hydroxy-3-methoxy-1-allylbenzene	2126·0 secs.
4-Hydroxy-3-methoxy-1-propenylbenzene ...	8160·0 ,,
3 : 4-Methylenedioxy-1-allylbenzene	682·6 ,,
3 : 4-Methylenedioxy-1-propenylbenzene.....	1161·8 ,,
Ethyl propyl ether	145·2 ,,
Ethyl allyl ether.....	140·7 ,,
Ethyl propargyl ether.....	206·2 ,,

The authors propose to extend this line of work to such cases as ring formation, hydroaromatic and aromatic compounds, spatial propinquity of unsaturated groupings, symmetrical and unsymmetrical substitution in aromatic compounds, and viscosity constants for the various homologous series.

343. "Physical properties of mixtures of ether and sulphuric acid." By James Robert Pound.

Mixtures of ether and "100 per cent. sulphuric acid" were chiefly used in this investigation; some work was done with ethereal solutions of 95 per cent. sulphuric acid. All the experiments were carried out at 30°, and in a few cases also at 20°. In the case of none of the physical properties examined do the solutions obey the "normal mixture" rule. The specific volumes are up to 10 per cent. less than the theoretical values. The contraction on mixing

is greatest about the equimolecular mixture. The conductivity of the mixtures with "the 100 per cent. acid" rises to a maximum for the 89 per cent. acid mixture. There is a sharp descent from this maximum to the minimum conductivity, which occurs with the 98 per cent. acid mixture. This minimum is similar to that obtained on adding a little water to 100 per cent. sulphuric acid. The viscosity curve for the ether–acid mixtures has a maximum at the 67 per cent. acid mixture, and closely resembles the corresponding curve for water–sulphuric acid solutions. Over the range from the 59 per cent. to the 89 per cent. acid mixture, the product of the viscosity and the conductivity varies linearly with the composition. The surface tensions, found by the method of drops, vary linearly with the composition over a large range—from the 20 per cent. to the 80 per cent. acid mixture. The vapour pressures of the solutions decrease as the percentage of acid increases, the fall of vapour pressure being greatest between the 40 per cent. and 50 per cent. acid mixture. Here, as in the previous cases mentioned, the curve resembles the corresponding one for water–sulphuric acid mixtures. The actual number or composition of the complexes that are certainly formed in the solutions cannot be given definitely.

344. "New syntheses of thioxanthone and its derivatives." (Preliminary note.) By Samuel Smiles.

In a previous communication (*Trans.*, 1910, **97**, 1290) it was shown that thioxanthone and its derivatives may be obtained by the condensation of aromatic substances with either *o*-carboxybenzenesulphinic acid or with *o*-thiolbenzoic acid. It has now been found that other four methods are available for the synthesis of these substances:

(1) Condensation of *o*-dithiobenzoic acid with aromatic derivatives in sulphuric acid.

(2) Condensation of *m*-hydroxy- or *m*-amino-benzoic acids with (*a*) suitable disulphides, or (*b*) certain sulphinic acids in sulphuric acid.

(3) Action of *o*-thiolbenzoic acid on certain quinones, and elimination of water from the product. The three last-named methods yield products the structures of which are known from those of the reagents. These reactions are being studied in detail.

345. "Cryoscopic, ebullioscopic, and association constants of trimethylcarbinol." By William Ringrose Gelston Atkins.

The cryoscopic constant of trimethylcarbinol was found to have the value $E=128$, from which, by van't Hoff's equation, the value

for the heat of fusion, $s=13{\cdot}84$ cal., is obtained. Taking de Forcrand's value, $s=20{\cdot}98$ cal., E (calc.) $=84{\cdot}5$. The appearance of the solid first in the form of minute needles, which soon change into orthorhombic plates, gives some ground for supposing that the experimental and calculated values of L differ because an unstable, crystalline modification is the first to separate out, in which $s=13{\cdot}84$, whereas $s=20{\cdot}98$ was determined from the stable form. This unstable form may be the modification which Tammann found to be stable only at high temperatures and pressures.

Boiling-point determinations give $E'=17{\cdot}45$; calculation from the equations of van't Hoff, Tsakalotos, and Baume gives values ranging from $E'=18{\cdot}97$ to $E'=19{\cdot}78$, whilst dp/dT (calc.) $=28{\cdot}4$.

Calculation from the observed values of γ_t by Ramsay and Shields' equation gives $x=1{\cdot}388$ from 35° to 47°, and $x=1{\cdot}304$ from 47° to 80°, whilst Walden's equation gives $x=1{\cdot}094$ at the boiling point, 82·5°. Longuinescu's relation gives $x=1{\cdot}12$ at 30°.

346. "The syntheses of 3-β-aminoethylindole and its formation from tryptophan." (Preliminary note.) By Arthur James Ewins and Patrick Playfair Laidlaw.

Since a number of bases derived from naturally occurring amino-acids have been recently shown to be physiologically active, it was thought desirable to prepare 3-β-aminoethylindole, the base corresponding with tryptophan (indole-3-α-aminopropionic acid). The base has been obtained in two ways.

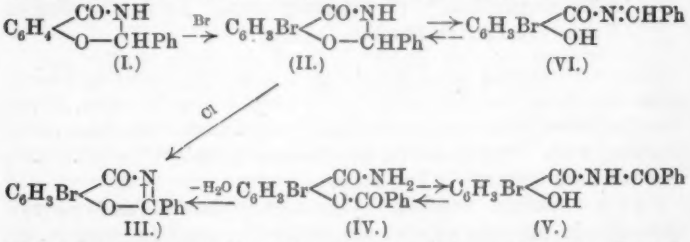
(1) By heating together γ-aminobutyrylacetal and phenylhydrazine in presence of zinc chloride. The reaction product, on suitable treatment, gives a good yield of the picrate of the desired base.

(2) By submitting tryptophan to the action of putrefactive organisms under conditions similar to those employed by Ackermann (*Zeitsch. physiol. Chem.*, 1910, **65**, 504) in the preparation of 4-β-aminoethylglyoxaline from histidine. A small quantity of a picrate identical in all respects with the synthetic compound was isolated. The base has been found to be physiologically active, producing a rise of blood pressure. The action has, however, yet to be fully worked out.

The details of the synthesis will, it is hoped, shortly be communicated, and experiments are in progress with a view to the production of other indole derivatives by the same process.

347. "6-Bromo-2-phenyldihydro-1 : 3-benzoxazine-4-one and related derivatives." By Ernest Chislett Hughes and Arthur Walsh Titherley.

2-Phenyldihydro-1 : 3-benzoxazine-4-one (I), on bromination in chloroform solution, yields the 6-*bromo*-derivative (II) (m. p. 223°), which, with chlorine in benzotrichloride solution at 110°, is dehydrogenated, and gives 6-*bromo*-2-*phenyl*-1 : 3-*benzoxazine*-4-*one* (III) (m. p. 208°). The latter is also obtained by dehydration of O-*benzoyl*-5-*bromosalicylamide* (IV) (m. p. 154°) under the catalytic influence of hydrogen chloride, and it suffers ring fission on hydrolysis in presence of alcoholic hydrochloric acid, producing N-*benzoyl*-5-*bromosalicylamide* (V) (m. p. 249°). *O*- and *N*-Benzoyl-5-bromosalicylamides show the same reciprocal transformations as the other previously-described *O*- and *N*-acylsalicylamides, and they have been obtained by similar methods. The dihydro-derivative (II) has been synthetically obtained from 5-bromosalicylamide and benzaldehyde, into which it decomposes on hydrolysis; whilst on treatment with alkali and pyridine, it rearranges to a very labile open-chain isomeride, syn-*benzylidene*-5-*bromosalicylamide* (VI).



(I.) (II.) (VI.) (III.) (IV.) (V.)

348. "Reactivity of the halogens in organic compounds. Part V. Interaction of esters of the bromo-substituted fatty acids with silver nitrate in alcoholic solution." By George Senter.

The relative rates with which the bromine is eliminated from the esters of the lower bromo-substituted fatty acids by means of silver nitrate in alcoholic solution have been measured at 49·9°, and in some cases at 26·0°. The results for the higher temperature are summarised in the table, in which k represents the relative velocity-coefficients under comparable conditions :

Ester.	$k \times 10^4$.
Ethyl bromoacetate.....	0·208
,, α-bromopropionate	0·085
,, α-bromo*iso*butyrate.....	0·062
,, α-bromobutyrate.....	0·038
,, α-bromo*iso*valerate	0·022
Methyl bromopropionate	0·077
Ethyl ,, ,, ...	0·085
n-Propyl ,, ,, ...	0·087

Measurements have also been made with methyl alcohol as solvent, and also in mixtures of ethyl alcohol with other solvents. The results were compared with those obtained for the corresponding acids (*Trans.*, 1910, **97**, 246), and the effect of substitution on the reactivity of the bromine was discussed.

349. "Attempts to prepare glycerides of amino-acids." By Roman Alpern and Charles Weizmann.

The following new compounds were described: *αα'-Dipropionin*, $C_9H_{16}O_5$, boiling at 170—173°/10 mm. *α-Bromoacetin*, $OH{\cdot}CH_2{\cdot}CH(OH){\cdot}CH_2{\cdot}O{\cdot}CO{\cdot}CH_2Br$, a yellow oil boiling at 217—219°/10 mm. *αα'-Diacetoacetin*, $C_{11}H_{16}O_7$, prepared by condensing acetoacetic ester and glycerol in the presence of sulphuric acid, a heavy, yellow oil with an odour recalling that of ethyl acetoacetate; it boils at 157—160°/14 mm. *αβ-Dichloroacetoacetin*, $CH_3{\cdot}CO{\cdot}CH_2{\cdot}CO_2{\cdot}CH_2{\cdot}CHCl{\cdot}CH_2Cl$, a liquid boiling at 103—105°/14 mm. *Ethyl* N-*allylglycine*, $CH_2{:}CH{\cdot}CH_2{\cdot}NH{\cdot}CH_2{\cdot}CO_2Et$, prepared from allylamine and ethyl bromoacetate in ice-cold ethereal solution, a liquid boiling at 74—77°/15 mm.

ADDITIONS TO THE LIBRARY.

III. *Pamphlets.*

Autenrieth, *W.*, and **Koenigsberger**, *J.* Ueber ein neues Kolorimeter und dessen Verwendung zur Bestimmung von Blutfarbstoff, Eisen, Indikan und Kreatinin. (From the *Münch. med. Woch.*, 1910.)

Bruce, *W.* Report on cattle-feeding experiments. (*Bull. Edinburgh and East of Scotland Coll. Agric.*, No. 21, 1910.)

Buckingham, *Edgar.* On the definition of the ideal gas. (From the *Bull. Bur. Standards*, 1909, **6**.)

Clacher, *William.* The use of the refractometer in the analysis of jams and jellies, marmalades and confections. (From the *Int. Sugar J.*, 1910.)

Dittrich, *Max*, and **Leonhard**, *A.* Ueber Eisenoxydulbestimmungen in Silicaten. (From the *Ber. Vers. Oberrheinisch. Geol. Ver.*, 1910, **43**.)

Johannesburg. *Government Laboratories.* Report 1908–09. pp. 16. Pretoria 1910.

Luzzatto, *R.*, and **Satta**, *G.* Intorno al comportamento nell' organismo

animale dei Jodoso-Jodil e Jodonio-composti. II. Comportamento del Jodil-benzolo. (From the *Arch. Farm. sperim. Sci.*, 1910, **9**.)

Menge, *George A.* A study of melting-point determinations. (*Bull. U.S. Hygienic Laboratory*, 1910, No. 70.)

Woburn Experimental Fruit Farm. Twelfth Report. By the **Duke of Bedford** and *Spencer U.* **Pickering.** pp. iv + 51. London 1910.

At the next Ordinary Scientific Meeting on **Thursday**, January **19th**, 1911, at **8.30** p.m., the following papers will be communicated:

"Intramolecular rearrangement of diphenylmethane *o*-sulphoxide." By T. P. Hilditch and S. Smiles.

"The reactions between chemical compounds and living muscle proteins." By V. H. Veley.

"The interaction of alloxan and glycine." By W. H. Hurtley and W. O. Wootton.

"The decomposition products of tetramethylammonium nitrite under the action of heat." By P. C. Rây and H. K. Sen.

"Retardation and acceleration in the dissolution of mercury in nitric acid in presence of minute quantities of ferric salts and manganese nitrate." By P. C. Rây.

"On *dl*- and *d*-Δ^{2}-*m*-menthenol(8) and *dl*- and *d*-$\Delta^{2:8(9)}$-*m*-menthadiene." By W. N. Haworth, W. H. Perkin and O. Wallach.

"The identity of xanthaline with papaveraldine." By Miss B. Dobson and W. H. Perkin.

"Amalgams containing silver and tin." By R. A. Joyner.

"Studies of the constitution of soap in solution: the electrical conductivity of sodium stearate solutions." By R. C. Bowden.

"Additive compounds of phenols and phenolic ethers with aromatic polynitro-derivatives." By J. J. Sudborough and S. H. Beard.

ERRATUM.

PROCEEDINGS, 1910.

Page	Line	
268	6	*for* "seven carbon ethers" *read* "seven-carbon ether (ethyl amyl ether)."

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